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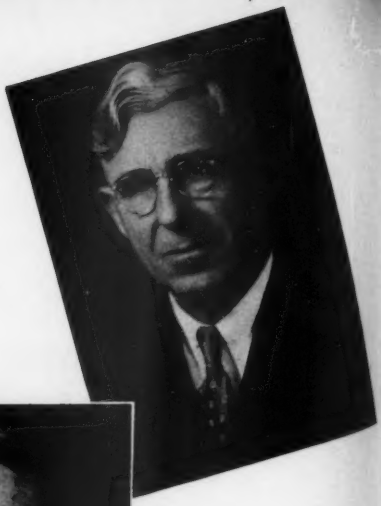

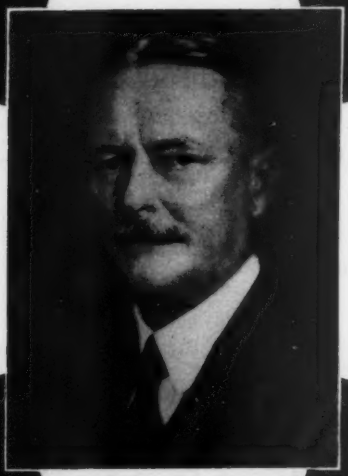

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PROFESSIONAL STATUS AND EMPLOYMENT OF GRADUATES.

STUDY OF THE METHODS USED BY ENGINEERING COLLEGES IN AIDING THEIR GRADUATES SECURE EMPLOYMENT

By RALPH M. BARNES

Professor of Industrial Engineering, College of Engineering, University of Iowa

Last October President C. C. Williams appointed a committee to study the professional status and employment of engineering graduates. Under the chairmanship of Dean Geo. C. Shaad this committee outlined a program covering important phases of the subject and it was suggested that a study be made of the methods used by engineering colleges in aiding their graduates and recent alumni in securing employment.

In order to get a rather full and detailed report of methods used at each engineering college it was felt that a statistical study alone would be inadequate. Therefore, in addition to using a short questionnaire a request was made that a full description of the methods used and an appraisal of these methods be returned with the questionnaire.

The letter shown in Fig. 1 and six copies of the questionnaire, shown in Fig. 2, were mailed to the dean of each of the 110 engineering colleges in the United States having institutional membership in the S. P. E. E.

In the letter (see Fig. 1) addressed to the dean of each school the following request was made:

1. If your college has a director of personnel or a designated person who handles such work for the entire college, please turn this letter and the attached blanks over to him for reply.
2. If the majority of placement work is handled directly by each department please distribute one of the enclosed blanks to the head of each department in your college for reply.

Questionnaires were answered and returned by 83 (or 75 per cent) of the 110 colleges receiving them. These returns have been tabulated by schools and departments on pages to and a summary of this information is shown in Fig. 3 and Fig. 4. An analysis of the replies by size of school is shown in Fig. 5.

In all, 175 replies were received from 83 different institutions.

The engineering enrollment of the schools reporting varied from 111 to 2,176. The results show that 24 institutions have their personnel work centralized and the remaining 59 institutions handle it largely by departments, although in some colleges the dean assists in this work. The fact that the 59 schools handling this work in a decentralized manner were asked to reply by departments accounts for the large number of replies from these schools. In some instances the dean replied for his school indicating that the methods of aiding students in finding work were much alike in all of the departments.

The response to the questionnaire was excellent. In addition to

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SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

Committee on Professional Status and Employment of Engineering Graduates

107 Engineering Bldg.
Iowa City, Iowa
March 1, 1935

Dear Sir:

The Committee on Professional Status and Employment of Engineering Graduates is making a study of the methods used by engineering colleges in aiding their graduates and recent alumni in securing employment. A digest of the survey will be given at the annual meeting in Atlanta, and a more complete report will probably appear in the JOURNAL.

1. If your college has a director of personnel or a designated person who handles such work for the entire college, please turn this letter and the attached blanks over to him for reply.

2. If the majority of placement work is handled directly by each department please distribute one of the enclosed blanks to the head of each department in your college for reply.

The committee will appreciate your coöperation in aiding the work of this study.

Yours very truly,

RALPH M. BARNES,
Member S. P. E. E. Committee on Professional Status and Employment of Engineering Graduates

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FIG. 1

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

Committee on Professional Status and Employment of Engineering Graduates

The Committee on Professional Status and Employment of Engineering Graduates is making a study of the methods used by engineering colleges in aiding their graduates and recent alumni in securing employment.

Will you please score the questionnaire for your department and return it to the address indicated at the bottom of the page by March 15.

1. FINDING WORK: Do you give your students advice or instruction on such topics as writing letters of application, preparing for interviews, kind of work to apply for, and other information that might be used to advantage by the engineering student in selling his services?

	Yes	No
(*a*) Do you give your students any help in finding work?	(—)	(—)
(*b*) Do you give such help by means of interviews?	(—)	(—)
(*c*) Do you give such help by means of recommended readings?	(—)	(—)
(*d*) Do you give such help by means of special lectures?	(—)	(—)
1. How many lectures do you give per year? (———)		
2. By whom given ————		
(*e*) Do you give such help by means of special courses?	(—)	(—)
1. Name of course ————		
2. Name of Instructor ———— Credit Hrs	(—)	

On separate sheet give methods you use in helping students find work. Please send a copy of any mimeographed or printed material that you give to the student to aid him in finding work.

2. Is your PLACEMENT WORK CENTRALIZED and handled by one person for the entire college? (—) If so, give name and title of such person ————
Or is this left to the individual member of the faculty? (—)
3. PERSONAL ANALYSIS: Do you give each student assistance in self-analysis, that is, helping him find the particular type of work for which he is best fitted, and in line with his interests? Yes (—) No (—). On a separate sheet please give a description of the methods you use.
4. ALUMNI: Do you have a systematic plan for aiding your recent alumni, two or three years out of school, in finding work? Yes (—) No (—). On a separate sheet please give a description of the methods you use.
5. YOUR APPRAISAL: On the back of this sheet please state your experience with methods of aiding students in finding work? Are you satisfied with the present methods you are using? What are the best features of your present method?

Name of Institution ———— Date ————
Name of College ———— Department ————
Name & title of person making reply ————
Address ———— ————
Number of graduates from your department (or college) last year (———).

Please return this sheet along with your supplementary data by March 15, 1935 to: RALPH M. BARNES, 107 Engineering Bldg.
University of Iowa, Iowa City, Ia.

FIG. 2

filling out the "yes" and "no" answers on the questionnaire many described their methods in great detail submitting exhibits of their forms, printed pamphlets and mimeographed material designed to help the student in finding work. Departments having little or no printed material also described their methods at length.

The writer studied all of this material very carefully and attempted to select typical statements which would give a fair cross section of the replies.

Methods Used in Aiding Students Find Work

Responsibility for Helping Students Find Work

All of those replying indicated that they gave students help in finding work. Some felt a complete responsibility for this as indicated by the following statements:

Answers		3	4	5	6	7	8				9	10	11
		Do you give your students help in finding work?	Do you give students such help by means of interviews?	Do you give students help by recommended readings?	Do you give students help by special lectures?	Do you give students such help by special courses?	a Is your placement work centralized?	b Under the Dean?	c Under Alumni Secretary?	d Under placement officer?	Is your placement work handled by Department heads and (or) by individual members of faculty?	Do you give students assistance in self-analysis?	Do you have a systematic plan for aiding your recent alumni in finding work?
Yes	Number	175	156	81	79	25	24	4	4	16*	151†	107	73
	Per cent	100	89	46	45	14	14				86	61	41
No	Number	0	11	68	81	128						49	87
	Per cent	0	6	39	46	73						28	50
Did not answer	Number	0	8	26	15	22						19	15
	Per cent	0	5	15	9	13						11	9
Total	Number	175	175	175	175	175						175	175
	Per cent	100	100	100	100	100						100	100

* 8 of these are under coördinators.

† 24 of these use both centralized and departmental placement administration.

Fig. 3. Summary of replies to questionnaires

We have done practically nothing to train the students to find positions for themselves for the reason that we consider it our duty to find jobs for them.

Graduates of this department have all been placed in the past through the department finding positions for them. As this department is relatively small all graduates have been placed almost immediately upon graduation.

A majority of those expressing an opinion on this point indicated a desire to help the student help himself. Typical opinions were:

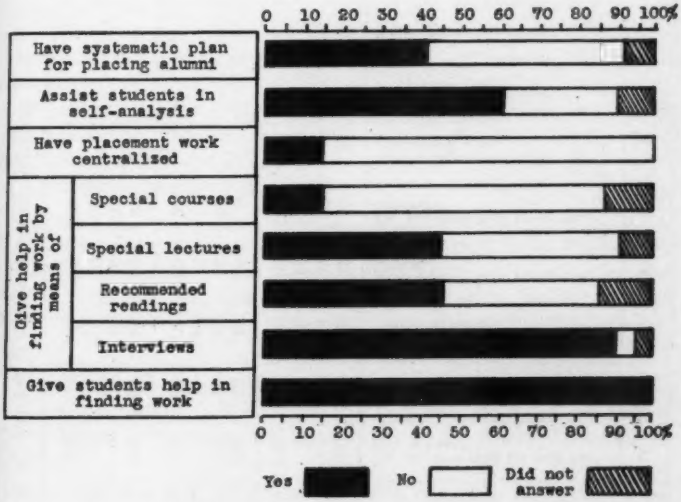
0 10 20 30 40 50 60 70 80 90 100%
Have systematic plan for placing alumni
Assist students in self-analysis
Have placement work centralized
Give help in finding work by means of
Special courses
Special lectures
Recommended readings
Interviews
Give students help in finding work
0 10 20 30 40 50 60 70 80 90 100%
Yes
No
Did not answer

FIG. 4. Summary of Replies to Questionnaires.

We can say that our men, aided by our records and technique, have done a splendid job of selling themselves. Perhaps our success in training the undergraduate to look for his own job has been most pleasing to us.

Since no personnel department is in operation in our school and since our instructors are carrying very heavy teaching loads, we do not feel that we can guarantee employment to our engineering school graduates or be responsible for seeing that they secure employment. The individual members of the faculty feel a personal interest in students who have taken work under their direction and in an unofficial and unorganized manner give them assistance in securing positions.

A number seemed to fear that too much assistance might do the student more harm than good. The following quotations present this point of view:

Size or Senior Class in Engineering		Replies in Per Cent	3	4	5	6	7	8				9	10	11
			Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	Do you give help by special lectures?	Do you give help by special courses?	a	b	c	d	Is your placement work handled by Department heads and individual members of the faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
								Is your placement work centralized?	Under the Dean of Engin.?	Under Alumni Secretary?	Under placement officer?			
Small 0–50	49 Replies 28%	Yes	100	90	48	33	15	8	4	0	4	92	62	35
		No	0	8	33	53	77						27	54
		Did not answer	0	2	19	14	8						11	11
		Total	100	100	100	100	100						100	100
Medium 51–200	100 Replies 57%	Yes	100	88	45	48	9	11	1	2	8	89	65	40
		No	0	7	44	44	77						27	54
		Did not answer	0	5	11	8	14						8	6
		Total	100	100	100	100	100						100	100
Large 201 and over	26 Replies 15%	Yes	100	86	46	54	38	31	4	4	23	69	54	61
		No	0	7	42	46	54						27	31
		Did not answer	0	7	12	0	8						19	8
		Total	100	100	100	100	100						100	100

FIG. 5. Analysis of replies by size of institution

I feel that the student should consider it his own responsibility to locate a position for himself, and that it would be a mistake to create conditions which would justify him in feeling that this should be done for him.

I believe that an engineering student should be trained in developing and manifesting his initiative. After four years he ought to have enough initiative and personality to go out and get a good job without a lot of "spoon feeding."

Interviews and Recommended Readings

Eighty-nine per cent of those replying to the questionnaire indicated that they gave the students help in finding work by means of interviews. Only six per cent stated that they gave no help in this manner.

While a few schools have a highly organized program for helping students by personal interviews, a large majority do this more informally as the need arises.

Typical comments were:

I believe that the personal contact method in which the student's advisor interviews him and talks over the kind of work he is interested in and also his capabilities for doing various kinds of work is the most effective method. The advisor should then contact a number of companies to ascertain whether or not they have any employment available and if so put the students interested in that type of work in direct contact with the company.

It is our policy to offer detailed advice to students concerning methods of securing a position. We are glad to look over letters of application, offer constructive criticism, and offer advice as to conduct during an interview.

Forty-six per cent of those returning the questionnaires recommended books, papers and articles on the subject of finding work. Thirty-nine per cent did not recommend readings and fifteen per cent did not answer this question.

Some gave the list of readings which they recommend. They included such references as:

1. "The Technical Man Sells his Services," by Edward Hurst, McGraw-Hill, New York, 239 pp., 1933.
2. "Finding Work," by Samuel S. Board, published by the American Society of Mechanical Engineers in pamphlet form, 29 pages. 1934. Also published in the November, 1934 issue of *Mechanical Engineering*.
3. "The Young Man in Business," by Howard L. Davis, John Wiley, N. Y., 172 pp., 1931.
4. "Student Development," by J. E. Walters, Isaac Pitman & Sons, N. Y., 195 pp., 1931.
5. "A Plan for Self-Management," by Everett W. Lord, Ronald Press, N. Y., 190 pp., 1925.

FIG. 5. Analysis of replies by size of institution

6. "How you Can Get a Job," by Glenn L. Gardiner, Harper Brothers, N. Y., 188 pp., 1934.
7. "New Careers for Youth," by W. B. Pitkin, Simon-Schuster, N. Y., 1934.
8. "Getting a Job and Getting Ahead," by Albert Fancher, Harper & Brothers, N. Y., 1931.
9. "How to Get a Job During the Depression," by W. C. Graham, Association Press, N. Y., 88 pp., 1932.
10. "Success in College and Business," by Donald S. Bridgman, *Personnel Jl.*, Vol. 9, No. 1, pp. 1–19, June, 1930.
11. "Jobs for College Men," by R. S. Uhrbrock, *Occupations*, January, 1935.
12. "Imagination Gets the Job," by John R. Tunis, *Review of Reviews*, p. 41, January, 1935.
13. "Suggestions to Junior Engineers," Engineers' Council for Professional Development, 10 pp., 1934.
14. "Finding a Job During the Depression," by H. D. Kitson, R. C. Cook Co., N. Y., 32 pp., 1933.

Special Lectures

Forty-five per cent of those replying to the questionnaire held special lectures with the primary purpose of helping students find work. Many schools give one, two, or three lectures a year to seniors while other schools give as many as 33 lectures on the subject during the student's four years. Two of the schools replying stated:

The ten departments of our schools of Engineering and Mines have weekly lectures given by men in industry. Each year several of these deal with placement and personal appearance, methods of getting jobs, interviews and similar matters. Also during the year the dean and heads of departments give several talks on these subjects to the seniors.

Three to four lectures are given to the senior class relative to securing a job by letter and personal interviews. A demonstration is given in recognized methods of procedure when applying for a job. Following this demonstration each student is given an opportunity to demonstrate his ability in making an interview for a job, a member of the English department pretending that he is an executive of a manufacturing concern. During the interview the rest of the class is looking on, noting the procedure. After the interview, as seems feasible, the good and bad points are pointed out to the student making the interview. Students like this plan very much and feel that experience before the class is well worth while. It is necessary to take students individually and talk to them as it would not be right to point out their failings in front of the class. Good judgment, naturally must be used in these demonstrations. It is one thing to talk about how to find a job and another to actually secure it. Therefore it is felt that a little practice before leaving school would be a good thing.

Special Courses

While 25 replies indicated that special courses on this subject were offered, nearly all stated that only part of the course related

to finding work. Seventy-three per cent of those replying indicated that they gave no such courses.

A cross section of opinion on this point can be seen in these statements:

In the fall of the senior year I take up the subject of employment in a seminar course which I have with the seniors. We discuss the types of employment open to engineering students and the type of work which in my judgment each student will find most satisfactory. I give them some instruction in the writing of letters of application and discuss with them the best methods for making contacts and conducting interviews with prospective employers.

During this past year we have arranged a special course of lectures dealing with employment. This course is being given in connection with the engineers club and has attracted a great deal of interest, not only among students of the university but also among other young engineers in the city.

I do not feel that an extended course of instruction in these matters is necessary.

A number of schools supplemented their answer on this point with the statement that their courses in senior English include some instruction in writing letters of application, in making personal interviews, etc.

Miscellaneous Aids

In addition to the above named methods of aiding students find work there were a number of others given. Some of these are presented in the following paragraphs:

For some fifteen years the senior class has gotten out a printed booklet in which the pictures and descriptions of each member of the senior class are presented. The booklet is distributed among four or five hundred industrial establishments in the state of Pennsylvania and adjoining states. This booklet has been a principal source of contact between individuals and graduates of the school. In addition to the copies sent out by the department each student is given 50 or more individual pages concerning himself alone which he uses in his correspondence. This booklet is paid for by the students themselves.

This year we plan to print a personnel leaflet (*similar to the one described above*) similar to that which is used at the University of Montana and at Iowa State College. These leaflets will be used to facilitate the work of the interviewers, and to contact prospective employers; and to supply faculty members with information which might be useful in making recommendations; and to simplify the work of the student in making an application for a position.

After using printed personnel leaflets for two years we have given up the idea. They have proved ineffective and also students do not want to spend $5.00 for them.

In making contact with possible employers we find it valuable to play up special features of our department. Our rayon laboratory makes a hit with the rayon industry and develops many jobs for chemical engineers. Our research and instruction in lubrication interest oil companies in our mechanical engineering graduates, etc.

Intelligent reading of the best daily papers is a valuable source of leads. There are continual announcements of industrial activities. To those who are alert and quick to take advantage of these news notes, many of them will prove fruitful. In one case a metropolitan newspaper carried a summary of the speech an executive of a large company had given the night before. He was quoted as saying he was looking for a certain type of young man for managerial training, but up to that time had been unsuccessful in locating what he wanted. Our bureau immediately wrote the gentleman, secured complete information concerning the positions available, and eventually placed two men with the company. In another instance, the financial sheet contained a short article stating a certain well known petroleum company was opening up new territory. Prompt action resulted in five placements. In still another case a company was written on the strength of an announcement in the newspaper that the organization had been awarded a government contract—several men of special training were placed. An article stating a certain mill had called back thousands of men suggested this company might again recruit college graduates for training—the hunch was correct—they did.

In schools offering courses in time and motion study where class problems are taken directly from local industries the report has been received that many members are absorbed by these industries. In one school requests were received for more men than there were members in the class.

Centralized vs. Decentralized Placement Work

Of the 83 colleges returning the questionnaires 24 had what might be considered centralized personnel offices. Sixteen of these schools had a separate personnel officer in charge. Eight of these sixteen were coördinators in coöperative schools.

In four colleges the placement work was handled by the dean of engineering and in four institutions this work was directed by the Alumni Secretary.

Twenty-four instances were reported where both the centralized and decentralized plan was used. Two illustrations of this are given below:

Our placement work may be said to be headed up under a College Committee called "Committee on Employment." . . . However, the heads of the departments and the members of the departments are really the persons who perform the major share of the personnel work.

Our professors are in touch with many industries and place many graduates directly. At the same time we have a central placement bureau that acts as a center and clearing house. A request for a graduate coming to the central bureau is discussed with the appropriate department head and the man for the position is selected. The placement bureau handles the details. However, the department places many men direct and simply informs the placement bureau of the action. The central bureau arranges for interviews between personnel officers and groups of interested students. It also keeps a file of all recent and mature graduates wishing positions and places many men who have been out of school for several years.

One hundred and twenty-seven replies to the questionnaire indicated that the department heads and members of the staff handled this work directly.

There was much discussion of this question of administration of placement work. Some believed that the centralized plan was best while others favored the decentralized scheme. The smaller schools in particular favored the latter method.

Typical statements from those favoring the decentralized plan were:

As our engineering college is small and because of the fact that we can give more or less individual attention to the matter of employment for graduates, we do not have an organized method for this work. We are in touch with a great many concerns and through the influence and coöperation of the members of the faculty and these concerns we are able to assist our students very materially in finding work.

The department head knows his men better than a central employment director possibly could, and, in my opinion, can operate more efficiently.

It is my judgment that employers prefer to make contact with those who have personal knowledge of the students and that therefore a centralized office cannot do as well as a member of departmental offices.

In the written comments returned with the 175 questionnaires 23 specifically stated that their present decentralized plan was satisfactory and that they favored this rather informal but generally intimate contact between the students and faculty.

On the other hand, many were of the opinion that the present

decentralized plan was unsatisfactory. Fifteen stated in their written comments that they were definitely considering centralizing their work or that they favored such a move. Some of the statements from these schools were:

The placement bureau which we are setting up will attempt to make contacts with employers and locate positions and should be much more successful than the unorganized efforts of individuals in the faculty whose time is so much taken up with other duties.

Our plan of aiding students worked quite satisfactorily during normal times but since the depression with increasing unemployment it has been difficult for the department head to take sufficient time from his regular duties to do full justice to increased work needed for placement. We feel that these duties can be handled better by a centralized placement department coöperating with the department head.

We do realize that conditions in the future are to be markedly different from the past and I believe we must arrange shortly to set up a more orderly procedure in order to insure the best opportunities for our men.

Our system could be improved so far as present conditions are concerned by having a senior member of the department relieved of part of his present teaching duties so that he might be able to spend time in correspondence with alumni and others in the endeavor to turn up jobs for unemployed alumni.

Aid in Student Self-Analysis

Sixty-one per cent of those replying stated that they help the student try to find the particular type of work for which he is best fitted and in which he will be happiest.

A very few schools indicated that they do this systematically,[1] while a large majority stated that they do it more or less informally as the occasion arises.

A majority of replies were similar to the following:

The greater number of our students have a pretty definite idea of what they want to do; with those who are in doubt we talk over the possible lines of endeavor and suggest means by which he may attempt to decide which one will be best for him.

It seems to me that the chairman of the department in which the student is registered, or his advisor is in a better position to know the shortcomings and good qualities of the individual student in his group.

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[1] See: "Personnel Methods in Use in Engineering Schools," *S. P. E. E. Jl.*, May, 1932, p. 746–777. "College Personnel Methods," by A. A. Potter, *Proceedings of S. P. E. E.*, Vol. 37, p. 277–284, 1929. "Sibley Personnel Rating Plan," *The Sibley Jl. of Engineering*, Vol. 42, No. 9, p. 323–325, December, 1928.

We have individual conferences with students in which we try to help the individual formulate a definite objective in terms of his own interests and abilities.

My personal four years' contact with the student on the one hand and my acquaintance with practicing engineers, officers in industrial companies and organizations assist me in placing the right student in the right place.

Aid to Recent Alumni

Forty-one per cent of those returning the questionnaire stated that they have a systematic plan for aiding their recent alumni in finding work. Fifty per cent have no systematic plan although many stated that they occasionally give help. Nine per cent returning the questionnaire did not answer this question.

Typical comments on this point were:

As for the men who have graduated previously to the class about to graduate we attempt to keep a complete record of employment. This department is at the present time completing a survey of the employment status of those graduates over the past ten years. In getting replies and information we have been about 85 per cent successful. We rate the men as to whether they are satisfactorily employed in work which justifies their having taken a course in electrical engineering; as unsatisfactorily employed, this is, employed at some kind of work which does not justify their having taken a course at the University and last the unemployed. I have a chart in my office which shows at a glance the employment status of any man who has graduated from this department in the last 10 years.

We are equally as interested in placing men who have been out of school a number of years as we are in placing the recent graduates.

All of our graduates were placed through the efforts of this department which thus became a clearing house for technical ceramic service. Calls for ceramic engineers and technologists with all amounts of practical experience come to us constantly. Last year this department was of service in placing more than 100 graduates who varied in graduation date from 1903 to 1934. All of 1934 graduates were placed.

We keep records of all graduates—personal data, experience, etc. We are also in rather close contact with the metallurgical industries of this region. We keep in contact with alumni through a semi-annual departmental publication.

There is no attempt made to circularize the alumni with regard to possible openings. There is no attempt made to inform an alumnus who has a position that a certain position is vacant unless it is specifically requested that it be done. In other words, the department does not attempt to undermine the organization of an industrial plant where an alumnus is employed.

1	2	3	4	5	6		7			8				9	10	11
					a	b	a	b	c	a	b	c	d			
Name of Institution	Name of Department	Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	Do you give help by special lectures?	How many lectures do you give per year?	Do you give help by special courses?	Credit hours of course	Part of course only	Is your placement work centralised?	Under Dean of Engin.?	Under Alumni Secretary?	Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
1. Univ. of Akron Sr. 111, Total 179 *	M.E.	Yes	Yes	No	No		—			Yes			C[1]	—	Yes	Yes
2. Univ. of Alabama Sr. 147, Total 605		Yes	Yes	No	No		No			Yes				Yes	Yes	No
3. Univ. of Arizona Sr. 47, Total 272		Yes	Yes	—	—		—			—				Yes	—	—
4. Univ. of Arkansas Sr. 32, Total 211		Yes	Yes	Yes	Yes	1	No			No				Yes	No	No
5. Armour Inst. Tech. Sr. 146, Total 772		Yes	Yes	No	Yes	1+	No			Yes			×	—	—	Yes
6. Poly. Inst. of Brooklyn Sr. 119, Total 782		Yes	Yes	—	Yes	2	No			Yes		×		—	No	No
7. Brown University Sr. 24, Total 116		Yes	Yes	Yes	No		No			—				Yes	Yes	No
8. Bucknell University Sr. 21, Total 133		Yes	Yes	Yes	No		No			No				Yes	Yes	No

* These enrollment figures for the senior class and total for the engineering college were taken from *S.P.E.E. Jl.*, Nov. 1934, p. 262–263, and Mar. 1934, p. 463.

[1] "C" Indicates that the placement officer is the coordinator in the cooperative division.

* These enrollment figures for the senior class and total for the engineering college were taken from *S.P.E.E. Jl.*, Nov. 1934, p. 262–263, and Mar. 1934, p. 463.

[1] "C" Indicates that the placement officer is the coordinator in the cooperative division.

9. Carnegie Inst. of Tech.....		Yes	Yes	Yes	Yes	2	Yes	—	×	Yes			×	—	Yes	Yes
Sr. 215, Total 1112																
10. Case School App. Sci.....		Yes	Yes	Yes	Yes	10	—			Yes				Yes	Yes	Yes
Sr. 122, Total 597																
11. Catholic Univ. of Am.....	C.E.	Yes	Yes	No	No		No			—				Yes	Yes	No
Sr. 26, Total 127	M.E. & Aero.	Yes	Yes	—	—		No			No				Yes	Yes	—
	E.E.	Yes	Yes	Yes	No		No			—				Yes	Yes	No
	Chem.	Yes	Yes	—	—		—			—				Yes	—	—
	Arch.	Yes	Yes	Yes	Yes	4	No			—				Yes	Yes	Yes
12. Clemson College.....	C.E.	Yes	Yes	No	Yes	1+	No			No				Yes	Yes	No
Sr. 66, Total 398	M.E.	Yes	Yes	Yes	No		No			—				Yes	No	No
	E.E.	Yes	Yes	Yes	Yes	—	No			No				Yes	Yes	Yes
13. Univ. of Colorado.....	C.E.	Yes	Yes	No	No		No			No				Yes	Yes	No
Sr. 114, Total 567	M.E.	Yes	Yes	Yes	Yes	3–4	No			No				Yes	Yes	No
	E.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
14. Colorado Agri. Col.....	C.E.	Yes	Yes	Yes	Yes	3	No			Yes				Yes	No	No
Sr. 223, Total 1386	M.E.	Yes	Yes	No	No		No			Yes				Yes	No	No
15. Cornell University.....		Yes	Yes	Yes	Yes	20	Yes	—		Yes			×	No	Yes	Yes
16. Univ. of Dayton.....	M.E.	Yes	Yes	—	Yes	1+	No			Yes		×		Yes	Yes	—
	E.E.	Yes	Yes	No	No		No			Yes		×		Yes	Yes	Yes
	Chem.	Yes	Yes	—	No		—			Yes		×		Yes	—	Yes
17. Univ. of Delaware.....		Yes	Yes	Yes	No		No			—				Yes	Yes	No
Sr. 27, Total 145																
18. Univ. of Detroit.....		Yes	Yes	Yes	Yes	2	—			Yes			C	Yes	Yes	Yes
Sr. 93, Total 414																
19. Drexel Institute.....		Yes	Yes	No	No		No			Yes			C	—	Yes	Yes
Sr. 92, Total 663																
20. Univ. of Florida.....	C.E.	Yes	Yes	Yes	Yes	1–2	No			—				Yes	Yes	—
Sr. 68, Total 425	M.E.	Yes	Yes	Yes	Yes	1+	No			—				Yes	Yes	No
	E.E.	Yes	Yes	No	Yes	1+	No			No				Yes	—	No
	Ch.E.	Yes	Yes	No	No		No			No				Yes	No	Yes

1	2	3	4	5	6		7			8				9	10	11
Name of Institution	Name of Department	Do you give student help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	a. Do you give help by special lectures?	b. How many lectures do you give per year?	a. Do you give help by special courses?	b. Credit hours of course	c. Part of course only	a. Is your placement work centralized?	b. Under Dean of Engin.?	c. Under Alumni Secretary?	d. Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
21. Ga. School of Tech.	C.E.	Yes	Yes	Yes	No		Yes	2	××	Yes				Yes	—	Yes
Sr. 340, Total 1783	M.E.	Yes	Yes	No	Yes	8	Yes	3		No				Yes	Yes	Yes
	Ch.E.	Yes	No	No	No		No			Yes				Yes	No	No
22. Harvard University		Yes	Yes	No	No		No			Yes				Yes	No	No
23. University of Idaho	C.E.	Yes	No	Yes	Yes	3–4	No			No				Yes	No	No
Sr. 55, Total 318	M.E.	Yes	Yes	Yes	Yes	—	No			No				Yes	Yes	No
	E.E.	Yes	Yes	No	Yes	1	No			No				Yes	Yes	No
	Ch.E.	Yes	Yes	Yes	No		No			No				Yes	—	No
	Agr.E.	Yes	Yes	Yes	Yes	2–3	No			No				Yes	No	No
24. Univ. of Illinois		Yes	Yes	No	Yes	1	—			Yes				Yes	Yes	Yes
Sr. 220, Total 1215									×							
25. Univ. of Iowa	M.E.	Yes	Yes	Yes	Yes	1	Yes	2		No				Yes	Yes	No
Sr. 65, Total 367	E.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	Yes	No
26. Johns Hopkins Univ.	C.E.	Yes	Yes	No	No		No	1		No				Yes	Yes	Yes
	M.E.	Yes	Yes	Yes	—		Yes			Yes				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	—		No			Yes				Yes	—	Yes
	Gas.E.	Yes	Yes	No	No		No			—				Yes	No	Yes

27. Kansas State Col.	C.E.	Yes	Yes	No	No		No			—				Yes	No	Yes
Sr. 138, Total 733	M.E.	Yes	Yes	No	No		No			No				Yes	Yes	No
	E.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	Yes	Yes
	Chem.	Yes	Yes	Yes	Yes	1–2	No			—				Yes	Yes	No
	Agr.E.	Yes	Yes	Yes	Yes	1	No			No				Yes	Yes	Yes
	Arch.	Yes	Yes	No	No		No			No				Yes	No	No
28. Univ. of Kansas	C.E.	Yes	Yes	—	—		—			—				Yes	No	Yes
Sr. 123, Total 506	M.E. & Ind.E.	Yes	Yes	Yes	Yes	2+	Yes	½		—				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	Yes	1–2	No			No				Yes	Yes	No
	Ch.E.	Yes	Yes	Yes	—		—			—				Yes	Yes	No
	Min.E.	Yes	Yes	—	—		—			—				Yes	Yes	Yes
	Arch.	Yes	Yes	—	—		—			No				Yes	Yes	No
29. Lafayette College		Yes	Yes	Yes	Yes	24	No			Yes			×	No	Yes	Yes
Sr. 62 *																
30. Lehigh University		Yes	Yes	Yes	Yes	14–15	No			Yes				Yes	Yes	Yes
Sr. 253, Total 1323																
31. Univ. of Louisville		Yes	Yes	Yes	Yes	33	No			No				Yes	Yes	Yes
Sr. 22 *																
32. Univ. of Maine	C.E.	Yes	Yes	No	Yes	1	No			—				Yes	Yes	No
Sr. 307, Total 1421	M.E.	Yes	Yes	Yes	No		No			No				Yes	No	No
	E.E.	Yes	Yes	Yes	Yes	1	No			No				Yes	No	No
	Ch.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
	Paper E.	Yes	Yes	Yes	No		Yes	2	×	No				Yes	Yes	Yes
33. Manhattan College		Yes	No	No	Yes	15	No			No				Yes	No	No
Sr. 36, Total 209																
34. Marquette Univ.		Yes	Yes	No	Yes	1+	Yes	2	×	Yes			C	No	Yes	No
Sr. 60, Total 382																
35. Univ. of Maryland		Yes	Yes	No	No		No			—				Yes	Yes	Yes
Sr. 43 *																
36. Mich. Coll. of Mines		Yes	Yes	Yes	No		—			Yes			×	Yes	Yes	No
Sr. 108 *																

* From Questionnaire.

1	2	3	4	5	6		7			8				9	10	11
Name of Institution	Name of Department	Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	a. Do you give help by special lectures?	b. How many lectures do you give per year?	a. Do you give help by special courses?	b. Credit hours of course	c. Part of course only	a. Is your placement work centralized?	b. Under Dean of Engin.?	c. Under Alumni Secretary?	d. Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
37. Mich. State College	C.E.	Yes	Yes	No	Yes	3–4	No			No				Yes	Yes	No
Sr. 88, Total 490	M.E.	Yes	Yes	Yes	—		—			—				Yes	—	—
	E.E.	Yes	Yes	No	No		No			No				Yes	Yes	No
38. Univ. of Michigan	C.E.	Yes	Yes	No	No		—			No				Yes	Yes	No
Sr. 339, Total 1485	Ch.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	No	Yes
	Aero. E.	Yes	—	—	No		No			Yes				Yes	—	—
	Naval Arch.	Yes	No	No	No		No			Yes				Yes	No	No
39. Univ. of Minnesota		Yes	Yes	No	No		No			Yes				Yes	No	Yes
Sr. 393, Total 1740																
40. Univ. of Missouri	C.E.	Yes	No	Yes	Yes	3	No			No				Yes	Yes	Yes
Sr. 53, Total 286	M.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	No	No
	E.E.	Yes	Yes	No	No		No			—				Yes	Yes	Yes
	Chem.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
	Mngt. E.	Yes	Yes	Yes	Yes	2	No			No				Yes	No	No
	Agr.E.	Yes	Yes	—	—		—			No				Yes	Yes	—
41. Montana St. Coll.		Yes	Yes	Yes	Yes	25	—			Yes	×			—	Yes	Yes
Sr. 60, Total 340																

42. Univ. of Nebraska	C.E.	Yes	No	Yes	No		Yes	2	×	—				Yes	Yes	Yes
	M.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
	E.E.	Yes	—	—	—		No			No				Yes	Yes	Yes
	Ch.E.	Yes	Yes	No	Yes	1	No			—				Yes	No	No
43. Newark Coll. of Eng.		Yes	Yes	Yes	No		No			Yes			C	—	Yes	Yes
Sr. 105, Total 651																
44. Univ. of New Hampshire		Yes	Yes	No	No		No			No				Yes	No	No
Sr. 64 *																
45. New York Univ.		Yes	Yes	—	No		—			Yes			C	—	Yes	Yes
46. Univ. of N. Car.		Yes	No	Yes	No		No			No				Yes	Yes	No
Sr. 44, Total 261																
47. N. Car. State Coll.	C.E.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	No		No			No				Yes	No	No
	Ch.E.	Yes	Yes	—	Yes	1	No			No				Yes	Yes	Yes
	Ceramic E.	Yes	Yes	No	No		No			No				Yes	Yes	No
48. Univ. of N. Dak.	C.E.	Yes	Yes	No	No		No			—				Yes	Yes	No
	M.E.	Yes	Yes	—	Yes	2	No			—				Yes	Yes	No
	E.E.	Yes	Yes	Yes	No		No			—				Yes	Yes	No
	Min. & Ch.E.	Yes	Yes	Yes	No		No			—				Yes	Yes	No
49. Northeastern Univ.		Yes	Yes	Yes	Yes	20	Yes	—		Yes			C	No	Yes	Yes
Sr. 248, Total 1363																
50. Ohio State Univ.	C.E.	Yes	Yes	No	No		Yes	3	×	No				Yes	—	Yes
Sr. 254, Total 1398	M.E.	Yes	—	—	Yes	1–3	Yes	3	×	No				Yes	—	—
	E.E.	Yes	Yes	No	Yes	1	No			No				Yes	Yes	Yes
	Ceramics	Yes	Yes	No	No		No			No				Yes	Yes	Yes
51. Ohio Northern Univ.		Yes	Yes	No	No		No			Yes	×			—	Yes	No
52. Oregon Agr. Coll.	C.E.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
Sr. 87, Total 521	M.E.	Yes	—	—	Yes	4–5	No			No				Yes	Yes	—
	E.E.	Yes	Yes	No	No		No			—				Yes	Yes	No
	Ch.E.	Yes	Yes	Yes	Yes	1	No			—				Yes	Yes	No

* From Questionnaire.

1	2	3	4	5	6		7			8				9	10	11
Name of Institution	Name of Department	Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	Do you give help by special lectures?	How many lectures do you give per year?	Do you give help by special courses?	Credit hours of course	Part of course only	Is your placement work centralized?	Under Dean of Engin.?	Under Alumni Secretary?	Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
					a	b	a	b	c	a	b	e	d			
21. Ga. School of Tech	C.E.	Yes	Yes	Yes	No	8	Yes	2	××	Yes				Yes	—	Yes
Sr. 340, Total 1783	M.E.	Yes	Yes	No	Yes		Yes	3		No				Yes	Yes	Yes
	Ch.E.	Yes	No	No	No		No			Yes				Yes	No	No
22. Harvard University	C.E.	Yes	Yes	No	No	3–4	No			No				Yes	No	No
23. University of Idaho	M.E.	Yes	Yes	Yes	Yes	—	No			No				Yes	Yes	No
Sr. 55, Total 318	E.E.	Yes	Yes	No	Yes	1	No			No				Yes	Yes	No
	Ch.E.	Yes	Yes	Yes	No	2–3	No			No				Yes	—	No
24. Univ. of Illinois	Agr.E.	Yes	Yes	Yes	Yes	1	—			Yes				Yes	No	No
Sr. 220, Total 1215		Yes	Yes	No	Yes		Yes	1		Yes				Yes	Yes	Yes
25. Univ. of Iowa	M.E.	Yes	Yes	Yes	—		Yes	2	×	No				Yes	Yes	No
Sr. 65, Total 367	E.E.	Yes	Yes	Yes	—		No			Yes				Yes	Yes	Yes
	C.E.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
26. Johns Hopkins Univ	M.E.	Yes	Yes	Yes	—		Yes	1		Yes				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	—		No			Yes				Yes	—	Yes
	Gas.E.	Yes	Yes	No	No		No			—				Yes	No	Yes

27. Kansas State Col.	C.E.	Yes	Yes	No	No		No			—				Yes	No	Yes
Sr. 138, Total 733	M.E.	Yes	Yes	No	No		No			No				Yes	Yes	No
	E.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	Yes	Yes
	Chem.	Yes	Yes	Yes	Yes	1–2	No			—				Yes	Yes	No
	Agr.E.	Yes	Yes	Yes	Yes	1	No			No				Yes	Yes	Yes
	Arch.	Yes	Yes	No	No		No			No				Yes	No	No
28. Univ. of Kansas	C.E.	Yes	Yes	—	—		—			—				Yes	No	Yes
Sr. 123, Total 506	M.E. & Ind.E.	Yes	Yes	Yes	Yes	2+	Yes	½		—				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	Yes	1–2	No			No				Yes	Yes	No
	Ch.E.	Yes	Yes	Yes	—		—			—				Yes	Yes	No
	Min.E.	Yes	Yes	—	—		—			—				Yes	Yes	Yes
	Arch.	Yes	Yes	—	—		—			No				Yes	Yes	No
29. Lafayette College		Yes	Yes	Yes	Yes	24	No			Yes			×	No	Yes	Yes
Sr. 62 *																
30. Lehigh University		Yes	Yes	Yes	Yes	14–15	No			Yes				Yes	Yes	Yes
Sr. 253, Total 1323																
31. Univ. of Louisville		Yes	Yes	Yes	Yes	33	No			No				Yes	Yes	Yes
Sr. 22 *																
32. Univ. of Maine	C.E.	Yes	Yes	No	Yes	1	No			—				Yes	Yes	No
Sr. 307, Total 1421	M.E.	Yes	Yes	Yes	No		No			No				Yes	No	No
	E.E.	Yes	Yes	Yes	Yes	1	No			No				Yes	No	No
	Ch.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
	Paper E.	Yes	Yes	Yes	No		Yes	2	×	No				Yes	Yes	Yes
33. Manhattan College		Yes	No	No	Yes	15	No			No				Yes	No	No
Sr. 36, Total 209																
34. Marquette Univ.		Yes	Yes	No	Yes	1+	Yes	2	×	Yes			C	No	Yes	No
Sr. 60, Total 382																
35. Univ. of Maryland		Yes	Yes	No	No		No			—				Yes	Yes	Yes
Sr. 43 *																
36. Mich. Coll. of Mines		Yes	Yes	Yes	No		—			Yes			×	Yes	Yes	No
Sr. 108 *																

* From Questionnaire.

1	2	3	4	5	6		7			8				9	10	11
Name of Institution	Name of Department	Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	Do you give help by special lectures?	How many lectures do you give per year?	Do you give help by special courses?	Credit hours of course	Part of course only	Is your placement work centralized?	Under Dean of Engin.?	Under Alumni Secretary?	Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
					a	b	a	b	c	a	b	c	d			
37. Mich. State College	C.E.	Yes	Yes	No	Yes	3–4	No			No				Yes	Yes	No
Sr. 88, Total 490	M.E.	Yes	Yes	Yes	—		—			—				Yes	—	—
	E.E.	Yes	Yes	No	No		No			No				Yes	Yes	No
38. Univ. of Michigan	C.E.	Yes	No	No	No		—			No				Yes	Yes	No
Sr. 339, Total 1485	Ch.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	No	Yes
	Aero. E.	Yes	—	—	No		No			Yes				Yes	—	—
	Naval Arch.	Yes	No	No	No		No			Yes				Yes	No	No
39. Univ. of Minnesota		Yes	Yes	No	No		No			Yes				Yes	No	Yes
Sr. 393, Total 1740																
40. Univ. of Missouri	C.E.	Yes	No	Yes	Yes	3	No			No				Yes	Yes	Yes
Sr. 53, Total 286	M.E.	Yes	Yes	Yes	Yes	2	No			No				Yes	No	No
	E.E.	Yes	Yes	No	No		No			—				Yes	Yes	Yes
	Chem.	Yes	Yes	Yes	No		No			No				Yes	Yes	Yes
	Mngt. E.	Yes	Yes	Yes	Yes	2	No			No				Yes	No	No
	Agr.E.	Yes	Yes	—	—		—			No				Yes	Yes	—
41. Montana St. Coll.		Yes	Yes	Yes	Yes	25	—			Yes	×			—	Yes	Yes
Sr. 60, Total 340																

42. Univ. of Nebraska	C.E.	Yes	No	Yes	No		Yes	2	×	—				Yes	Yes	Yes
	M.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
	E.E.	Yes	—	—	—		No			No				Yes	Yes	Yes
	Ch.E.	Yes	Yes	No	Yes	1	No			—				Yes	No	No
43. Newark Coll. of Eng		Yes	Yes	Yes	No		No			Yes			C	—	Yes	Yes
Sr. 105, Total 651																
44. Univ. of New Hampshire		Yes	Yes	No	No		No			No				Yes	No	No
Sr. 64 *																
45. New York Univ		Yes	Yes	—	No		—			Yes			C	—	Yes	Yes
46. Univ. of N. Car		Yes	No	Yes	No		No			No				Yes	Yes	No
Sr. 44, Total 261																
47. N. Car. State Coll	C.E.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	No		No			No				Yes	No	No
	Ch.E.	Yes	Yes	—	Yes	1	No			No				Yes	Yes	Yes
	Ceramic E.	Yes	Yes	No	No		No			No				Yes	Yes	No
48. Univ. of N. Dak	C.E.	Yes	Yes	No	No		No			—				Yes	Yes	No
	M.E.	Yes	Yes	—	Yes	2	No			—				Yes	Yes	No
	E.E.	Yes	Yes	Yes	No		No			—				Yes	Yes	No
	Min. & Ch.E.	Yes	Yes	Yes	No		No			—				Yes	Yes	No
49. Northeastern Univ		Yes	Yes	Yes	Yes	20	Yes	—		Yes			C	No	Yes	Yes
Sr. 248, Total 1363																
50. Ohio State Univ	C.E.	Yes	Yes	No	No		Yes	3	×	No				Yes	—	Yes
Sr. 254, Total 1398	M.E.	Yes	—	—	Yes	1–3	Yes	3	×	No				Yes	—	—
	E.E.	Yes	Yes	No	Yes	1	No			No				Yes	Yes	Yes
	Ceramics	Yes	Yes	No	No		No			No				Yes	Yes	Yes
51. Ohio Northern Univ		Yes	Yes	No	No		No			Yes	×			—	Yes	No
52. Oregon Agr. Coll	C.E.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
Sr. 87, Total 521	M.E.	Yes	—	—	Yes	4–5	No			No				Yes	Yes	—
	E.E.	Yes	Yes	No	No		No			—				Yes	Yes	No
	Ch.E.	Yes	Yes	Yes	Yes	1	No			—				Yes	Yes	No

* From Questionnaire.

1	2	3	4	5	6		7			8				9	10	11
Name of Institution	Name of Department	Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	a Do you give help by special lectures?	b How many lectures do you give per year?	a Do you give help by special courses?	b Credit hours of course	c Part of course only	a Is your placement work centralized?	b Under Dean of Engin.?	c Under Alumni Secretary?	d Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
53. Penn. State Coll.	C.E.	Yes	Yes	Yes	Yes	2–3	No			No				Yes	Yes	Yes
Sr. 175, Total 841	M.E.	Yes	Yes	No	Yes	1–2	No			No				Yes	No	Yes
	E.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
	Ind.E.	Yes	—	Yes	Yes	2–4	Yes	2	×	No				Yes	Yes	No
	Arch.	Yes	Yes	Yes	No		No			No				Yes	Yes	No
54. University of Penn		Yes	Yes	Yes	Yes	—	Yes	—		Yes			×	—	Yes	Yes
55. University of Pitt		Yes	Yes	No	Yes	3–6	No			Yes			×	Yes	Yes	Yes
Sr. 132, Total 665																
56. Princeton Univ.		Yes	No	Yes	No		No			Yes	×			—	No	No
Sr. 48, Total 242																
57. Purdue University		Yes	Yes	Yes	Yes	14	Yes	3	×	Yes			×	—	Yes	Yes
Sr. 444, Total 2176																
58. Rensselaer Poly		Yes	Yes	—	Yes	2	Yes	—	×	Yes		×		—	—	Yes
Sr. 354 *																
59. Rice Institute		Yes	Yes	No	No		No			No				Yes	No	No
Sr. 52 *																

60. Rose Poly. Inst.	C.E.	Yes	Yes	No	No		No			No				Yes	No	No
Sr. 53, Total 187	M.E.	Yes	Yes	No	No		No			—				Yes	No	No
	E.E.	Yes	—	No	No		No			No				Yes	Yes	Yes
	Ch.E.	Yes	Yes	No	No		No			—				Yes	Yes	No
61. S.D. State Coll.		Yes	Yes	Yes	Yes	3–5	Yes	2	×	—				Yes	Yes	—
Sr. 27 *																
62. S.D. School of Mines.	C.E.	Yes	Yes	—	Yes	3	—			No				Yes	Yes	No
Sr. 42, Total 267	E.E.	Yes	Yes	No	Yes	3	Yes	2		No				Yes	No	No
	Ch.E.	Yes	—	—	Yes	10	Yes	2	×	No				Yes	Yes	No
63. So. Methodist Univ.		Yes	Yes	Yes	No		No			Yes			C	—	Yes	Yes
Sr. 26, Total 111																
64. Stanford University.		Yes	Yes	No	No		No			Yes				Yes	No	Yes
65. Stevens Inst. Tech.		Yes	Yes	Yes	Yes	1	—			Yes		×		—	Yes	Yes
Sr. 92 *																
66. Swarthmore College		Yes	Yes	Yes	No		No			Yes				Yes	Yes	Yes
67. Univ. of Tenn.		Yes	Yes	Yes	Yes	3	No			Yes			×	—	Yes	Yes
68. A. & M. Coll. of Texas.	C.E.	Yes	No	No	No		Yes	2	×	No				Yes	No	No
Sr. 177, Total 1416	M.E.	Yes	Yes	No	Yes	1–2	No			No				Yes	No	No
	E.E.	Yes	Yes	No	Yes	3	No			No				Yes	Yes	No
69. Texas Tech. Coll.	C.E.	Yes	Yes	No	No		No			No				Yes	No	No
	M.E.	Yes	Yes	No	No		—			—				Yes	No	No
	E.E.	Yes	Yes	Yes	No		Yes	0		No				Yes	Yes	—
	Ch.E.	Yes	Yes	Yes	No		No			—				Yes	—	No
	Textile	Yes	Yes	Yes	No		No			—				Yes	Yes	No
	Arch.	Yes	Yes	No	No		No			No				Yes	—	—
	Geology	Yes	Yes	—	No		No			No				Yes	No	Yes
70. Univ. of Texas.	C.E.	Yes	—	No	No		No			—				Yes	No	No
	M.E.	Yes	Yes	—	Yes	2	No			No				Yes	Yes	No
	Arch.	Yes	Yes	No	Yes	1+	No			—				Yes	No	No
71. Univ. of Toledo.		Yes	Yes	Yes	Yes	3–4	No			Yes			×	No	Yes	Yes
Sr. 30, Total 246																

* From Questionnaire.

1	2	3	4	5	6		7			8				9	10	11
Name of Institution	Name of Department	Do you give students help in finding work?	Do you give help by means of interviews?	Do you give help by recommended readings?	Do you give help by special lectures?	How many lectures do you give per year?	Do you give help by special courses?	Credit hours of course	Part of course only	Is your placement work centralized?	Under Dean of Engin.?	Under Alumni Secretary?	Under placement officer?	Is your placement work handled by Department heads and individual members of faculty?	Do you give student assistance in self-analysis?	Do you have systematic plan for placing alumni?
		a	a	a	a	b	a	b	c	a	b	c	d			
72. Tulane Univ. of La		Yes	No	No	No		No			Yes	×			—	—	Yes
Sr. 49, Total 297																
73. Univ. of Utah	C.E.	Yes	Yes	No	No		Yes	3	×	No				Yes	No	Yes
	E.E.	Yes	Yes	No	Yes	4	No			No				Yes	No	No
	Mining	Yes	Yes	—	Yes	2–4	No			No				Yes	—	No
	Metalgy.	Yes	Yes	No	No		No			Yes	×			—	No	Yes
74. Vanderbilt Univ.		Yes	Yes	Yes	Yes	6	No			Yes				Yes	No	No
Sr. 28*																
75. Univ. of Vermont		Yes	Yes	Yes	Yes	2	No			Yes	×			Yes	No	Yes
Sr. 27, Total 123																
76. Virginia Poly. Inst		Yes	Yes	Yes	No		No							Yes	No	No
Sr. 160, Total 947																
77. Univ. of Virginia		Yes	Yes	No	No		No			No				Yes	No	No
Sr. 38*																

* From Questionnaire.

78. Univ. of Wash	C.E.	Yes	Yes	Yes	No		No			No				Yes	Yes	Yes
Sr. 164, Total 1090	M.E.	Yes	Yes	No	No		No			No				Yes	Yes	Yes
	E.E.	Yes	Yes	Yes	Yes	1	No			No				Yes	No	No
	Ch.E.	Yes	Yes	No	Yes	1	No			No				Yes	Yes	No
79. Washington Univ. (St. L.)		Yes	Yes	—	—		—			Yes				Yes	No	—
Sr. 50, Total 372																
80. State Coll. of Wash		Yes	Yes	Yes	Yes	3–6	Yes	0	×	Yes				Yes	Yes	Yes
Sr. 58 *																
81. West Va. Univ		Yes	Yes	No	No		No			No				Yes	No	No
Sr. 47 *																
82. Worcester Polytech	C.E.	Yes	No	No	Yes	1	No			No				Yes	No	Yes
Sr. 106, Total 579	M.E.	Yes	Yes	Yes	Yes	8	No			Yes		×		Yes	No	Yes
	E.E.	Yes	Yes	Yes	Yes	2–3	No			No				Yes	Yes	Yes
	Chem.	Yes	Yes	Yes	No		No			Yes				Yes	—	—
83. Univ. of Wyoming	C.E.	Yes	Yes	Yes	—		Yes	3		—				Yes	Yes	Yes
Sr. 23, Total 167	M.E.	Yes	Yes	—	—		Yes	3		—				Yes	Yes	No

We have no systematic plan for our alumni though we endeavor to keep in touch with our graduates not only on account of our interest in them but because we have from time to time calls for men who have had experience in a definite field or who may be particularly fitted for some opening.

It is easier and more satisfactory for the senior student and graduate to keep in touch with the department head than for the department head to attempt to keep in touch with his graduates. It is therefore the duty of the senior student and graduate to keep his department head fully and frequently informed as to his availability, his success in securing a position, and as to progress after position is secured.

Conclusions

Engineering colleges as a whole are making a determined effort to help their graduates find work. Apparently there is less feeling of responsibility for placing recent alumni. This is probably due more to lack of time on the part of the faculty than to disinterestedness.

Centralized placement work is more prevalent in the larger engineering schools than in the smaller schools. Placement work was found to be centralized in thirty-one per cent of the large engineering schools, in eleven per cent of the medium sized schools, and in eight per cent of the small schools (see Fig. 5).

Two thirds of all schools with centralized placement departments have this work administered by placement officers, one sixth by the dean of engineering and one sixth by the alumni secretary.

While there is a very decided difference of opinion as to the best method of administering placement work, the results show that in a large majority of the engineering schools this work is handled by department heads, and by individual members of the faculty. The results also show marked evidences of a desire to improve placement methods and a feeling of the growing importance of this work.

The questionnaires brought out the fact that there is a rather definite technique of finding work such as analyzing and finding one's special aptitudes, contacting interested firms, writing letters of application, holding interviews, and favorably presenting and selling one's services, and that engineers can be given definite aid along these lines. The tabulated results indicate that recommended readings and special lectures are the methods most frequently used in this work. Only fourteen per cent of the schools answering have special courses or a definite part of an existing course devoted to this subject.

Several outstanding and detailed reports of centralized place-

ment work were received along with the questionnaires. Because of the originality and excellence of one or two of these plans it is hoped that they may be presented in full in the JOURNAL in the near future.

OBTAINING ENGINEERING EMPLOYMENT

BY J. E. WALTERS

Purdue University

IN COLLABORATION WITH G. C. SHAAD, University of Kansas; J. R. BANGS, Cornell University; R. M. BARNES, University of Iowa; M. M. BORING, General Electric Co.; R. I. REES, American Tel. & Tel. Co.; K. L. WILDES, Mass. Inst. of Tech.

Having completed four years' higher education in preparation for the engineering profession, the graduate is faced with the task of securing employment. You may ask "Is there a definite procedure which he can follow in order to find suitable employment?" In an endeavor to answer this question, the Committee wishes to offer a few suggestions which may prove helpful.

One direct plan found successful by many engineering seniors and graduates in outstanding engineering colleges has been to make (I) a *personal analysis*, and (II) an *employment survey*.

Finding a job is a problem of selling one's services. Since an engineer normally solves difficult problems in a logical and systematic manner, he should attack this employment problem likewise.

The first step in determining the kind of work you should seek requires personal analysis—that is, the determination of just what you have to sell. A student often overlooks this phase of the problem, thinking that a degree from a recognized engineering college is sufficient to recommend him. Instead, he should make an inventory of his accomplishments, personality traits, and training. Not only will you find such an analysis invaluable in helping you determine the type of work for which you are best equipped, but the prospective employer will ask for much of this information either directly or indirectly.

To make such an analysis, you should begin by making a *written* record of such items as these:

A. Courses in high school and college.

1. What subjects did you take?
2. What were your grades in each?
3. Which subjects were most interesting? What least interesting?

4. Which, if any, of the subjects you have taken have been of value in your outside work or activities thus far?

B. Remunerative work in high school and college—evenings and Saturdays—summer vacations.

But this information is *the* important part of the record.

1. Did you get along well with your employer? Your associates?
2. What particular part of your work did you like best? Least? Why?
3. Were you ever made "boss" or "leader" in any of this work?
4. Did you ever assume leadership when working with others?

C. Extra-curricular activities in high school and college.

1. To what organizations do you belong?
2. What elective positions have you held?
3. Did you direct others or did you do the work yourself?
4. What do your associates think of you as a leader?
5. Which of your extra-curricular activities did you like best?

D. Hobbies.

1. Do they provide real relaxation?
2. Do they involve other people?
3. Are they chiefly physical or mental?
4. Do they interfere with your primary job?

E. Personality Traits.

It is essential that you develop the best traits possible. Figure 1 which is the personality rating scale used in the Personnel Service of the Schools of Engineering at Purdue University, to rate the students, shows the traits considered most essential to success by 406 employers and others, as indicated in a survey conducted by that University.

A plan which you can use is to ask ten or more experienced people to rate you on a scale similar to the one shown. You can have these sent to some friend, so that the raters will give their confidential opinion. Your personnel department or one of your professors may serve you in this respect.

Then it is necessary to *study* the analysis given by others and use it, not only to help you find a position, but to *improve* your "personality."

PURDUE UNIVERSITY
PERSONNEL SERVICE
ENGINEERING ADMINISTRATION BUILDING
LAFAYETTE, INDIANA

CONFIDENTIAL

My dear.....:

Purdue University is interested in developing not only that important trait, intellectual ability, as shown by success in scholastic attainments, but also the **personality** of its students.

Mr.....has given us your name as a reference. You will aid us greatly in our efforts to help him derive the maximum benefits from his studies at Purdue by grading him on the following traits which a recent survey of student, faculty, alumni, and employer opinions indicated as the most essential for the best personality. Rate only those traits that are known to you and return this form to the address given above.

Please place a check mark (V) on the scale after each one of the six traits at the point which you consider best indicates his rating in comparison to persons of similar age, educational preparation, and environment, preferably those in his own class at the university. Please consider one trait at a time, and do not let your judgment on one trait be influenced by your total or general opinion of him. Read carefully the descriptive phrases after each trait before checking. For example, under **HONESTY**, if the student is **easily tempted and must be watched**, place a check in that classification's subdivision which you think best indicates his approach to the other classifications thus: | | V | | | | (Easily tempted)

if you consider him in the lowest part of that classification. If he is nearer the division **can be trusted** in most circumstances but is still in the **easily tempted** division, place the check in the upper part of that division, and so on for each trait, rating the student on each trait at the exact place on the scale which you think best shows his rating. If you do not know any one trait well enough to rate it, check in the space to the right of the scale of that trait designated **No opportunity to observe.** If you do not know this person well enough to give any rating, please return the blank unrated and check the space **I do not know him** at the bottom of the sheet.

In the space labeled Remarks, below each trait, will you please record any instances that support your judgment, or add any comments which may assist us in helping this student with reference to that trait? For example, under **APPEARANCE**, you may wish to add under Remarks such comments as: *Usually careless of personal appearance, clothes not neat, hair rarely combed,* or any other specific type of behavior. We appreciate your cooperation in rating this student.

Very truly yours,

Approved: *A. A. POTTER*, Dean of Engineering. *J. E. WALTERS*, Director of Personnel.

		No Opportunity to Observe
HONESTY: Remarks	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 Cannot be trusted at all · Easily tempted; must be watched · Can be trusted in most situations · Trustworthy under all circumstances	
JUDGMENT: Remarks	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 Does no reasoning for himself · Others cannot depend on his decisions · Level-headed; has common sense; decisions show thought · Makes excellent decisions quickly	
INITIATIVE: Remarks	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 Always depends upon others; never takes the initiative · Routine worker; rarely takes the initiative · Develops assigned field of work; gives good suggestions; independent worker · Develops new methods; promoter type; always starts things	
INDUSTRIOUSNESS: Remarks	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 Lazy; will not work · Takes things easy; does enough to get by · Persistent on assigned work · Enthusiastic worker; does extra work	
COOPERATIVENESS: Remarks	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Intolerant; cannot work with others · Causes occasional friction; frequently cannot work with others · Adjustable to ideas of others; adaptable · Works well with others · Goes out of his way to assist others	
APPEARANCE: Remarks	1 2 3 4 5 6 7 8 9 10 11 Repulsive to others · Given little attention to appearance; open to criticism · No objectionable features; usually neat and clean · Striking appearance; highly attractive	

What are his particularly strong points?.....

What are his particular weaknesses?.....

What kind of work do you consider him best fitted for?.....

How well do you know this student?

We are intimate friends | I know him rather well | We are acquainted, usually in classes | I know of him | I do not know him

Signature.....

NM-8-31
Form D1

FIG. 1. Personality rating scale.

F. Interests.

It is important that your interests are similar to those of prominent engineers. *The Strong Vocational Interest Blank* was constructed on the basis of the interests and dislikes of successful engineers. It will provide you with an index of your engineering interests. Copies can be obtained from Stanford University, and possibly your personnel or psychology department may have copies. The scores on this Blank should help you determine where your interest lies. However, do not use just one criterion to judge your interests and abilities, but as many as you can obtain, such as ratings, intelligence and aptitude tests, interest tests, course marks, etc.

A careful study of the results of this personal analysis should help you know your major abilities, chief interests, strength and weakness. After the analysis, the knowledge secured from reading about different companies, the different fields of engineering, and from asking questions of prominent engineers in these fields, should help to guide you in selecting the field of employment and even the names of companies for which you would be qualified. Get all of the information possible about yourself, the companies, and the fields of employment. Such information is the key to successful placement.

After you have made your self-analysis and are reasonably sure what kind of engineering employment you desire, you can proceed to make a *survey* of that particular type, or types of employment.

In making a *survey of employment*, the first step is to search for the names of companies offering employment along the line, or lines desired, by means of professional and trade directories, industrial magazines, etc., in the specialty which you have chosen. The Personnel Department should have a list of companies who have employed graduates in the past few years. The alumni engaged in the particular type of work which you have chosen, who live in the different localities where you live or would like to work, may be able to supply additional names of companies and assist you in making a favorable contact. If you are interested in railway work the *Railway Officials Guide* lists all officers of railroads; in Public Utilities, the *McGraw-Hill Central Station Directory* could furnish you with this valuable information; and, if you are interested in manufacturing concerns, the Thomas' Register or Donnelley's Industrial Directory may prove a useful reference. The numerous associations, professional directories and classified lists will aid you in making a *preferred* list of companies and firms.

After you have made a list of thirty or forty companies in your particular specialty, you should endeavor to secure further infor-

mation about these prospective employers through magazines, your professors, alumni, and the financial reports (such as Babson's, Dunn and Bradstreet's, Poor's, and Moody's). Delete some of the original list and then investigate the remainder more thoroughly until you have the list down to ten or twenty. The companies listed may not have any definite job to offer at the moment. Even so, this preliminary survey has been found to be a good plan, because if you accept employment with one company, you know something about its competitors or associate companies. In other words, you are better acquainted with industry of your choice by a study of *specific* companies. Do not slight this preliminary research, because *proper employment depends upon definite planning and research.*

You should consider whether each company affords you an opportunity for gaining proper experience. It should also offer you facilities for making use of your training and aptitudes; it should give you the possibility for personal development; and it should show that it has stability and prospects for future growth and development. If these are evident from the information which you have found and from the ratings of the company which you have obtained, *your next task is to apply for a position.*

In applying for any position it is considered best to appear in person. However, in many cases this is impossible and you must present yourself to the company by letter. You should take the list of companies which you have investigated, and endeavor to find the name of the man responsible for the employment of engineering graduates in each particular case. If you can learn this through your own source of information, you may save much time which might be lost by corresponding indirectly.

If the company is near, you should by all means apply personally and interview those who have the responsibility of employing college men. This gives you an opportunity to look over the organization, and at the same time provides the firm with an opportunity to appraise you. However, do not, as a rule, appear for an interview without being granted this privilege *as a result of correspondence.* And that is why it is so vitally important.

Regarding the interview, the following suggestions may serve useful: Have a friend examine your personal appearance critically and completely before the interview. Good taste in dress, fine appearance, poise, and good posture are important. Telephone the person with whom you have the appointment immediately beforehand, and determine whether or not it is still convenient for him to see you at this time. Go *alone* for the interview. A good plan is to ask yourself all of the questions you can possibly conceive of being asked, and formulate some definite answers. Also have in-

telligent, significant, and definite questions to ask. You will be judged greatly by those questions. Having prepared yourself in this manner you will be able to avoid the irritating vagueness, confusion, and resulting poor impression which is frequently an inevitable result of failure to plan in detail, in advance for the interview. Be prepared to give direct answers to questions, and to give concise and definite information about yourself. Do not require the busy interviewer to "pump" you unduly for information about yourself. Sincerity, modesty, and good manners are most essential. Avoid personal inquiries, and rude curiosity, such as attempting to read correspondence or other papers on the interviewer's desk, listening to his telephone conversation, etc.

Flattering the person or company to whom you are applying for work is found ineffective unless done most carefully and with sincerity. Look the interviewer in the eye, sit erect and alert, and be pleasant. State the essential fact concerning yourself, the kind of position you desire and your ambitions, the experience you have had, your education, training, and personal information such as age, married or single, health, etc. Have definite ideas about what you have done, can do, and *want* to do. Have something of definite value to offer. Do not say that you can do anything, because, first, you can *not* do anything, and second, employers are *not* interested in a man who has such vague interests. Do not appear *too* anxious. If asked what salary or wage you expect, do not say you will work for nothing, for the employer may think that is all you are worth. Be prepared to state simply and definitely the minimum amount for which you believe you are willing to work. Show the employer that you are well acquainted with the wage or salaries of others in similar positions. Sometimes it may be advisable to offer to work for a minimum amount during a trial period in which you will prove your worth. Never tell a "sympathy" or "hard luck" story! Do not apologize for work you have done formerly.

Take along samples of your work—drawings you have made, machine design, a notebook or a laboratory report, or a paper you have written. If you have conducted any special laboratory investigation, made an extended study in any field, or done anything outstanding, capitalize on it *by all means.*

In preparing for the interview, try to discover ways in which your training and experience would be of immediate value to the employer. He will be doubly interested in you if he feels that you can soon be earning money for him. Even though your ideas do not meet with his approval, the employer may be favorably impressed because you have ideas.

An introduction by a friend and letters of recommendation should stop at that. Do not overemphasize them or yourself.

Have a typewritten summary of your qualifications to leave with the interviewer, and give your address and telephone number. If asked to return for a reply, *ask for a definite date.* Follow up your interview by a letter, and keep persistently in touch with the person in the company in the event that there is the least possibility of employment. If there is a vacancy and you do not get the position, try to see why you failed, even to the extent of asking the interviewer who may be willing to help you that much. Persistence is important. Be pleasant, consistent, and determined, but do not take too much of the employer's time. One graduate received employment on the thirteenth time he visited a company.

If it is not possible to have a personal interview with the employer, *you will find the proper framing of your letter very important.* A number of methods of writing letters of application have been investigated at Purdue University, and the most successful method was found to be, to send personal information to the companies by means of a Personnel Information Blank,[1] and to enclose a *short* letter concerning the possibilities of serving in the particular kind of work for which you are qualified *in that particular company.* In any application, personal or written, try to relate your aptitudes to the needs of the company to which you are applying. Learn to talk about the company's products and business. Securing proper employment is a business proposition throughout. An employer is buying your services and will be interested in *your possibilities of increasing his profits.*

You should fill in the personnel information blank very carefully, and have typewritten as many copies as needed, with a *good* small full-faced photograph attached to each form. Don't use "snap-shots." The company will usually reply to such applications if anything is available. If it does not, a follow-up letter has been found to be worth the effort. Do not get discouraged. However, you may hear from several companies. Investigate these in detail, find out more precise information concerning the work, your own fitness, and the company. Continue this procedure until you locate an interesting opening.

While the process of writing letters of application is going on, be certain to investigate, *personally,* all companies in your own home town and locality which might have employment for you. After your list of local or near-by companies is completed, visit several each day. Learn the employment manager's name before calling. Use the telephone liberally. Follow up all leads persistently. The continuation of your writing, visits, investigation, and research, seems the best way to get a job even during a depression.

After you have written a letter to the company, an application

[1] See sample Information Blank, Figure 2.

Personnel Form 4J

3-25-SM

PERSONNEL INFORMATION BLANK

Issued by the Personnel Service, Schools of Engineering, Purdue University, Lafayette, Indiana; J. E. Walters, Director of Personnel

Name in Full _____ (Last) _____ (First) _____ (Middle)

University Address _____

Permanent or Home Address _____

Course _____ Class of 19

Age _____ Height _____ Weight _____

Nationality _____ Color _____

Married or Single _____ Dependents _____

Father's Occupation _____

Paste small Full Face Photograph Here.

Education:	Name of School	Course taken	How long	Year Graduated
High School				
University				
Other Universities				
Corresp'dence Courses etc.				

Church Membership: _____

Honors and Honorary Organizations: _____

Social Fraternity, Lodges and Secret Org's. _____

Percent of your expenses earned in college, _____ %. How? _____

Scholarship Record: _____

Athletic, Campus and Other Activities _____

Practical Experience: With Whom	Kind of Work	How Long
(1)		
(2)		
(3)		
(4)		
(5)		

Personality Ratings in University:

Health Record: _____

Kind of Work Wanted _____

References: Name	Address	Occupation

Remarks: _____

FIG. 2.

blank may be returned to you to be filled in. Do so whether or not you have already given the information before. Try to do every reasonable requirement the way the company wants it even though you may not want to do it that way. You should make sure that you definitely want the work which that company has to offer before making the final application. With some companies the acceptance of an application is considered a contract from their point of view. This is another reason for sending the personnel information; it is not strictly an application for employment, yet provides the desired information. You should follow up all replies from the companies by correspondence and interviews if possible, until final employment is secured.

If you have had any summer experience in engineering or industry, this may serve as a valuable contact for obtaining permanent employment after graduation.

Other opportunities for permanent employment may be provided by the University placement bureau. Professors often are requested to recommend people. The Personnel Department usually has knowledge of positions available. Important, too, is the consideration that representatives of industrial concerns and professional offices visit the campus during the school year to select men qualified for their work. You should interview the employment scouts of all the companies who come to the campus with positions to offer in which you might be interested. Their interviews are important contacts. They give the representative of the company an opportunity to see whether you are qualified, and give you experience in interviewing. You should never lose an opportunity for making an employment contact with any concern or person who could offer you a position in which you might be interested. In fact, you should take advantage of every possibility to secure *by and for yourself* the sort of employment for which you are best fitted.

Suggested References on How to Secure Engineering Employment

*Board, S. S.: "Finding Work." *Mechanical Engineering.* 1934.

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*Dooley, C. F.: "How to Get and Keep a Job." New York. Appointment Office, Columbia University.

Fancher, Albert: "Getting a Job and Getting Ahead." New York. Harper & Bros. 1931.

Farr, A. V.: "Getting the Job You Want." New York. American Institute of Educational Research. 1931. 62 pp.

Gardiner, Glen L.: "How You Can Get a Job." New York. Harper & Bros. 1934. 188 pp.

Gebler, R. T.: "Get That Job." New York. F. A. Stokes Co. 1932. 160 pp.

*GRAHAM, W. C.: "How to Get a Job During the Depression." New York. Association Press. 1932. 88 pp.
*HURST, E.: "The Technical Man Sells His Services." New York. McGraw-Hill. 1933. 32 pp.
*KITSON, H. D.: "Finding a Job During the Depression." New York. R. C. Cook Co. 1933. 32 pp.
KNAWLSON, T. S.: "Selling Your Ability." New York. Esser-Frederick. 1933. 297 pp.
LORD, EVERETT W.: "A Plan for Self-Management." Ronald Press Co.
MILLS, JOHN: "Starting as an Engineer and Engineering Aptitudes." American Telephone and Telegraph Co.
*PICKARD, R. O.: "Your Job—How to Get It and How to Keep It." Dodd, Meade & Co. 1933.
PITKIN, W. B.: "New Careers for Youth." New York. Simon & Schuster. 1934. 236 pp.
PITKIN, W. B.: "The Chance of a Lifetime." New York. Simon & Schuster.
RYDER, VIOLET, AND DOUST, H. B.: "Make Your Own Job." New York. H. H. Wilson Co. 1934.
*WALTERS, J. E.: "Student Development." Isaac Pitman & Sons.

COLLEGE GRADUATE PLACEMENT SURVEY

BY M. M. BORING

General Electric Company

In 1932 an attempt was made to determine what percentage of engineering graduates were being placed in industry. There has been so much discussion of the so-called "lost generations" that it seemed that we might receive some very useful information from a compilation of actual placement figures. The information available at that time was quite meager and, although we found that about 30 per cent of the engineering graduates were being placed, the information received was quite inadequate. Apparently this attempted survey aroused enough curiosity among some of our college people so that they began gathering information of a placement nature.

In the fall of 1934 approximately 80 colleges were again approached for information on the placement of graduates of the School of Engineering, the Graduate School, the School of Business, and of Arts and Science for 1931, 1932, 1933, and 1934. It seemed useless to include all types of college graduates, as statistical figures on the placement of those in medicine, law, and similar programs would be of little value. The information requested involved the number of graduates who were satisfactorily placed, who went into

* Reference is especially recommended.

teaching, who were on stop-gap jobs, who were unemployed, and who went into post-graduate work. The satisfactory placement was broken down into industrial placement and teaching, as it would be of interest to know what percentage of college graduates were actually continuing with the teaching profession. The results of this survey were very gratifying and useful information was received from a large number of institutions.

It is interesting to note that of the grand total of 22,000 students covered in the survey, 54.5 per cent were satisfactorily placed in industry and 6.1 per cent were placed in teaching, making a total satisfactory placement of 60.6 per cent. Only 11.1 per cent of all graduates were employed on stop-gap jobs, 14.2 per cent were unemployed, and 9.8 per cent were taking graduate work. The placement of these college people was broken down as completely as possible as outlined in the attached tabulation. It is again interesting that among 8,524 engineers, 59 per cent were satisfactorily placed in industry, 2.5 per cent in teaching, 16.7 per cent were on stop-gap jobs, 18.5 per cent were unemployed and 4.26 per cent were in graduate work. There is very little difference in the placement of graduates of the various branches of engineering, although the mechanical, civil, and chemical groups seem to be slightly higher than the electrical. The School of Business indicates that its placements are approximately the same as those of engineering, whereas the School of Arts and Science has made a much lower percentage of satisfactory placements, indicating that industry in general is more interested in the student with a specific training than one of general education. It is also interesting to note in this survey that a very large percentage of college graduates have apparently found suitable positions through their own initiative.

This survey was completed during the latter part of 1934 and was presented at the meeting of the American College Personnel Association. At that time copies were sent to a large number of engineering and other schools so that possibly quite a few of the people present have already seen this survey. Since completing this survey similar data have been received from a few other schools which have not been included in the attached survey as it would make no appreciable difference in the percentages.

Following the completion of this survey, it seemed wise again to approach the colleges in an attempt to gather information concerning the types of positions accepted by those who were satisfactorily placed. Approximately 80 engineering colleges were approached in this connection asking them to give us as best they could statistical information as to how many graduates had gone into the types of positions they would have considered satisfactory in 1929, or in normal times; also, how many students were satisfactorily placed

in positions of a non-engineering nature and how many had gone with organizations which had not previously taken engineering graduates. Replies to this request were received from approximately 25 engineering colleges. Unfortunately the information received was of a general nature, although enough statistical data were included so that the trend is indicated by the attached tabulation. No attempt to include numbers was made, as a considerable portion of the information was already in percentages.

Apparently there is a strong movement for engineering graduates to enter fields of sales, production, and general engineering rather than in the highly technical. Undoubtedly, a large number of young men are finding that their engineering education is useful in fields outside the purely technical line. Also there is undoubtedly a greater "satisfactory placement" of the class of 1935 than of the classes of the other depression years. Many people feel that there is a distinct swing back to 1929 conditions when the seniors are again being approached by a large number of industrial representatives regarding employment. Undoubtedly the placement of engineering graduates in new fields of endeavor will lead to similar placement for future graduates.

In order to give a definite idea of the trends of placement, quotations from a few of the letters received in this connection are presented:

"We are slowly building up outlets for our graduates in statistical work in banks and brokerage firms and for accounting and sales divisions of engineering firms. We could go farther and faster if we were able to persuade our younger graduates to enter these fields for which they are on the average well equipped."

"93 are employed and 45 of this number are in engineering jobs."

"Comparatively few of these men were placed directly through contact with employers by means of representatives visiting the University. Of course, we aided, where we could, but a review of the positions held indicated that many of the employment channels open five years ago have been greatly restricted, and that, for the most part, getting work during the past five years has depended very much upon the initiative of the individual graduate."

"It is to be noted that the total number of men going into general engineering and miscellaneous has shown a steady increase from 13.7 per cent in the '25–'27 period to 25 per cent in 1931, 50 per cent in 1932, 59 per cent in 1933, and 82 per cent in 1934. These figures are in accordance with what seems to me to be a general change in the type of employment, namely a shift from the old line, Public Utility-Communication-Electric Manufacturing groups to a much more widely scattered and diversified type of work."

"Our graduates at the present time are taking any kind of work offered and naturally the work is not all in the electrical engineering field. A number of concerns which heretofore have not taken technical graduates now seem to be definitely headed in that direction, and I am inclined to believe that in the future a greater proportion of our men are going to obtain employment among smaller industrial organizations than has been the case in the past."

"My observations regarding the possibility that there is a decidedly changing picture in the placement of engineering graduates indicate to me that there is such a changing picture. I suspect that it is too early to know what the new picture will look like."

"About 20 per cent are going into new small organizations and jobs outside the engineering field."

"Of the satisfactory placements, 5 have gone into jobs which would have been satisfactory in 1929, 8 have taken jobs outside the engineering field in small organizations that had not previously accepted engineering graduates."

"It seems to me that there is considerable indication that young engineering graduates and their college advisers are becoming somewhat better adjusted to the employment situation and are finding through new channels a surprising number of opportunities for young engineers to begin their careers."

"We know that a number have gone into jobs with organizations which had not in general employed young engineers and some have gone into types of work to which engineers have not usually been invited but which are, nevertheless, engineering in character. You are, no doubt, right that there is a change because students who are finding jobs for themselves are exploring new avenues and are finding positions which are satisfying, at least temporarily, and I think many of them are quite definitely permanent."

"The only comment I can make with regard to the engineering group as a whole is that there seems to be an increasing tendency for these men to enter the sales engineering field in lieu of more restricted opportunities in manufacturing production and other engineering fields into which most of them went prior to 1929."

"Apparently there has been a definite shift from the highly technical openings to those of a general engineering nature as, for example, a shift from engineering, development and design, to general plant engineering in manufacturing establishments. This has necessarily resulted in a number of men going into smaller organizations where they are receiving valuable experience in both business and engineering lines."

"I find that the personal representatives of certain large companies, who have hitherto contacted graduates of our College of Commerce only, are now taking an interest in and interviewing our engineering graduates. These representatives are looking for the salesman type."

SATISFACTORY PLACEMENTS

OF ALL

ENGINEERING GRADUATES OF THE CLASSES OF 1931 TO 1934 INCLUSIVE

% In private business		2%
% In commercial work and in organizations that do not ordinarily employ engineering graduates. (Sales, accounting, banks, stores, etc.)		13%
% In organizations that usually employ engineering graduates		85%
Total		100%
% Of total employed in manufacturing organizations		60%
% Of total in engineering operations	18%	
Research, design, and testing	13%	
Total in technical jobs	31%	
% Of total in Sales	8%	
Production	8%	
Business Operation	5%	
Miscellaneous	8%	
% Of total employed in Miscellaneous Organizations		25%
% Of total with Government	9%	
Highways	6%	
Communication and Public Utilities	10%	

COLLEGE GRADUATE PLACEMENT AS OF NOVEMBER 1, 1934

In making a survey of the placement of college graduates from the classes of 1931, 1932, 1933 and 1934, questionnaires were sent to the individual departments of approximately 100 colleges and the results indicate that many of our institutions of higher learning are unable to supply statistical information concerning their graduates. This is especially true of the college of Arts and Science. Some institutions have given us complete information on all departments covered in this survey, others complete information on some individual departments. Others indicate that their survey is only an approximation, and some were unable to furnish any information whatever. For this reason it has been necessary to total the group in Arts and Science, segregating where possible the group trained in Science only. The survey includes the total group in Business and the total in Engineering, although we have been able to tabulate the group in Engineering according to individual departments with some degree of success as the attached survey indicates.

In this survey those graduates whose locations were reported as unknown are equally divided between those unemployed and those employed on work of a stop-gap nature. All married women, deceased graduates, and graduates not placed because of illness are eliminated.

COLLEGE GRADUATE PLACEMENT AS OF NOVEMBER 1, 1934

Grand Total

		Satisfactory Placements	Teaching	Stop-Gap Placements	Unemployed	Post Graduates	Total
Men							
1931	No...	2,604	202	505	567	434	4,322
	%..	61.0	4.5	11.5	13.0	10.0	
1932	No...	2,478	174	577	630	280	4,139
	%..	59.8	4.2	14.0	15.2	6.8	
1933	No...	2,820	141	603	823	308	4,695
	%..	60.0	3.0	12.8	17.7	6.5	
1934	No...	2,874	172	759	1,175	605	5,585
	%..	51.2	3.1	13.5	21.4	10.8	
Total	No...	10,776	689	2,444	3,195	1,627	18,731
	%..	57.2	3.7	13.1	17.1	8.9	
Women							
1931	No...	275	196	56	153	61	741
	%..	37.1	26.5	7.5	20.7	8.2	
1932	No...	302	139	55	166	70	732
	%..	41.2	19.1	27.5	22.6	9.6	
1933	No...	294	131	82	156	74	737
	%..	40.0	17.8	11.0	21.2	10.0	
1934	No...	340	172	152	285	146	1,095
	%..	31.0	15.7	13.9	26.1	13.3	
Total	No...	1,211	638	345	760	351	3,305
	%..	36.6	19.5	10.4	22.9	10.6	
Total Men and Women							
1931	No...	2,879	398	561	720	495	5,053
	%..	57.0	7.9	11.1	14.2	9.8	
1932	No...	2,780	313	632	796	350	4,871
	%..	57.0	6.2	12.9	16.2	7.7	
1933	No...	3,114	272	685	979	382	5,432
	%..	57.2	5.0	12.4	18.2	7.2	
1934	No...	3,214	344	911	1,460	751	6,680
	%..	48.2	5.1	13.6	21.8	11.3	
Total	No...	11,987	1,327	2,789	3,955	1,978	22,036
	%..	54.5	6.1	12.5	17.9	9.0	

Arts and Science

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	92	58	45	77	104	376
	%..	24.6	15.4	12.0	20.3	27.7	
1932	No...	80	45	41	75	100	341
	%..	23.2	13.4	12.0	22.0	29.4	
1933	No...	97	52	58	95	83	385
	%..	25.2	13.4	15.0	24.7	21.6	
1934	No...	139	63	104	124	278	708
	%..	19.7	8.9	14.7	17.3	39.4	
Total	No...	408	218	248	371	565	1,810
	%..	22.5	12.1	13.7	20.5	31.2	
Women							
1931	No...	80	141	23	75	46	365
	%..	21.9	38.6	6.4	20.5	12.6	
1932	No...	59	90	31	103	49	332
	%..	17.8	27.1	9.3	31.1	14.7	
1933	No...	90	75	56	77	57	355
	%..	25.4	21.2	15.7	21.7	16.0	
1934	No...	122	137	121	185	122	687
	%..	17.8	19.9	17.7	26.9	17.7	
Total	No...	351	443	231	440	274	1,739
	%..	20.2	25.5	13.3	25.3	15.7	
Total Men and Women							
1931	No...	172	199	68	152	150	742
	%..	23.3	27.0	9.0	20.5	20.2	
1932	No...	139	135	72	178	149	673
	%..	20.7	20.0	10.6	26.5	22.2	
1933	No...	187	127	114	172	140	740
	%..	25.3	17.2	15.3	23.2	19.0	
1934	No...	261	200	225	309	400	1,397
	%..	18.7	14.4	16.1	22.1	28.7	
Total	No...	759	661	479	811	839	3,549
	%..	21.4	18.6	13.5	22.9	23.6	

Science

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	27	5	5	10	3	50
	%..	54.0	10.0	10.0	20.0	6.0	
1932	No...	31	8	9	19	6	73
	%..	42.6	10.9	12.3	26.0	8.2	
1933	No...	57	7	10	39	39	162
	%..	41.4	4.4	6.2	24.0	24.0	
1934	No...	90	20	17	49	57	233
	%..	38.6	8.6	7.4	21.0	24.4	
Total	No...	215	40	41	117	105	518
	%..	41.5	7.7	7.9	22.6	20.3	
Women							
1931	No...	0	1	0	0	0	1
	%..	0	100.0	0	0	0	
1932	No...	0	1	0	0	0	1
	%..	0	100.0	0	0	0	
1933	No...	6	1	0	0	2	9
	%..	66.6	11.2	0	0	22.2	
1934	No...	2	1	0	0	3	6
	%..	33.3	16.7	0	0	50.0	
Total	No...	8	4	0	0	5	17
	%..	47.0	23.6	0	0	29.4	
Total Men and Women							
1931	No...	27	6	5	10	3	51
	%..	53.0	11.7	9.8	19.6	5.9	
1932	No...	31	9	9	19	6	74
	%..	42.0	12.0	12.0	26.0	8.0	
1933	No...	73	8	10	39	41	171
	%..	42.7	4.7	5.8	22.8	24.0	
1934	No...	92	21	17	49	60	239
	%..	38.5	8.8	7.3	20.4	25.0	
Total	No...	223	34	41	117	110	535
	%..	42.0	7.0	8.0	22.0	21.0	

Arts and Science

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	92	58	45	77	104	376
	%..	24.6	15.4	12.0	20.3	27.7	
1932	No...	80	45	41	75	100	341
	%..	23.2	13.4	12.0	22.0	29.4	
1933	No...	97	52	58	95	83	385
	%..	25.2	13.4	15.0	24.7	21.6	
1934	No...	139	63	104	124	278	708
	%..	19.7	8.9	14.7	17.3	39.4	
Total	No...	408	218	248	371	565	1,810
	%..	22.5	12.1	13.7	20.5	31.2	
Women							
1931	No...	80	141	23	75	46	365
	%..	21.9	38.6	6.4	20.5	12.6	
1932	No...	59	90	31	103	49	332
	%..	17.8	27.1	9.3	31.1	14.7	
1933	No...	90	75	56	77	57	355
	%..	25.4	21.2	15.7	21.7	16.0	
1934	No...	122	137	121	185	122	687
	%..	17.8	19.9	17.7	26.9	17.7	
Total	No...	351	443	231	440	274	1,739
	%..	20.2	25.5	13.3	25.3	15.7	
Total Men and Women							
1931	No...	172	199	68	152	150	742
	%..	23.3	27.0	9.0	20.5	20.2	
1932	No...	139	135	72	178	149	673
	%..	20.7	20.0	10.6	26.5	22.2	
1933	No...	187	127	114	172	140	740
	%..	25.3	17.2	15.3	23.2	19.0	
1934	No...	261	200	225	309	400	1,397
	%..	18.7	14.4	16.1	22.1	28.7	
Total	No...	759	661	479	811	839	3,549
	%..	21.4	18.6	13.5	22.9	23.6	

Science

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	27	5	5	10	3	50
	%..	54.0	10.0	10.0	20.0	6.0	
1932	No...	31	8	9	19	6	73
	%..	42.6	10.9	12.3	26.0	8.2	
1933	No...	57	7	10	39	39	162
	%..	41.4	4.4	6.2	24.0	24.0	
1934	No...	90	20	17	49	57	233
	%..	38.6	8.6	7.4	21.0	24.4	
Total	No...	215	40	41	117	105	518
	%..	41.5	7.7	7.9	22.6	20.3	
Women							
1931	No...	0	1	0	0	0	1
	%..	0	100.0	0	0	0	
1932	No...	0	1	0	0	0	1
	%..	0	100.0	0	0	0	
1933	No...	6	1	0	0	2	9
	%..	66.6	11.2	0	0	22.2	
1934	No...	2	1	0	0	3	6
	%..	33.3	16.7	0	0	50.0	
Total	No...	8	4	0	0	5	17
	%..	47.0	23.6	0	0	29.4	
Total Men and Women							
1931	No...	27	6	5	10	3	51
	%..	53.0	11.7	9.8	19.6	5.9	
1932	No...	31	9	9	19	6	74
	%..	42.0	12.0	12.0	26.0	8.0	
1933	No...	73	8	10	39	41	171
	%..	42.7	4.7	5.8	22.8	24.0	
1934	No...	92	21	17	49	60	239
	%..	38.5	8.8	7.3	20.4	25.0	
Total	No...	223	34	41	117	110	535
	%..	42.0	7.0	8.0	22.0	21.0	

Arts and Science + Science

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	119	63	50	87	107	426
	%..	28.1	14.8	11.7	20.2	25.2	
1932	No...	111	53	50	94	106	414
	%..	26.7	12.7	12.2	22.6	25.8	
1933	No...	164	59	68	134	122	547
	%..	30.0	10.8	12.4	24.5	22.3	
1934	No...	229	83	121	173	335	941
	%..	24.3	8.8	12.9	18.4	35.6	
Total	No...	623	258	289	488	670	2,328
	%..	26.7	11.1	12.5	21.0	28.7	
Women							
1931	No...	80	142	23	75	46	366
	%..	21.8	38.8	6.3	20.6	12.5	
1932	No...	59	91	31	103	49	333
	%..	17.7	27.3	9.3	31.0	14.7	
1933	No...	96	76	56	77	59	364
	%..	26.3	20.9	15.4	21.1	16.3	
1934	No...	124	138	121	185	125	693
	%..	17.9	19.9	17.5	26.7	18.0	
Total	No...	359	447	231	440	279	1,756
	%..	20.5	25.4	13.2	25.0	15.9	
Total Men and Women							
1931	No...	199	205	73	162	153	792
	%..	25.2	25.8	9.3	20.4	19.3	
1932	No...	170	144	81	197	155	747
	%..	22.8	19.2	10.8	26.4	20.8	
1933	No...	260	135	124	211	181	911
	%..	28.5	14.8	13.6	23.2	19.9	
1934	No...	353	221	242	358	460	1,634
	%..	21.6	13.5	14.9	21.9	28.1	
Total	No...	982	705	520	928	949	4,084
	%..	24.0	17.3	12.8	22.7	23.2	

Business

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	574	44	139	136	57	950
	%..	60.4	4.6	14.6	14.4	6.0	
1932	No...	579	46	140	165	80	1,010
	%..	57.2	4.6	13.9	16.4	7.9	
1933	No...	678	33	176	152	69	1,108
	%..	61.2	3.0	15.8	13.8	6.2	
1934	No...	702	39	174	172	91	1,178
	%..	59.5	3.4	14.8	14.5	7.8	
Total	No...	2,533	162	629	625	297	4,246
	%..	59.6	3.8	14.8	14.7	7.1	
Women							
1931	No...	67	15	20	38	4	144
	%..	46.6	10.4	13.9	26.3	2.8	
1932	No...	71	12	16	22	8	129
	%..	55.0	9.3	12.4	17.1	6.2	
1933	No...	63	21	21	27	6	138
	%..	45.6	15.2	15.2	19.5	4.5	
1934	No...	74	9	22	31	9	145
	%..	51.1	6.2	15.1	21.4	6.2	
Total	No...	275	57	79	118	27	556
	%..	49.6	10.2	14.2	21.2	4.8	
Total Men and Women							
1931	No...	641	59	159	174	61	1,094
	%..	58.5	5.4	14.5	15.8	5.8	
1932	No...	650	58	156	187	88	1,139
	%..	57.0	5.2	13.7	16.4	7.7	
1933	No...	741	54	197	179	75	1,246
	%..	59.4	4.4	15.8	14.3	6.1	
1934	No...	776	48	196	203	100	1,323
	%..	58.6	3.5	14.8	15.4	7.7	
Total	No...	2,808	219	708	743	324	4,802
	%..	58.4	4.6	14.8	15.4	6.8	

Total Engineering

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Men							
1931	No...	1,121	70	296	231	29	1,757
	%..	64.0	4.0	16.8	13.2	7.0	
1932	No...	1,101	62	354	274	64	1,855
	%..	59.5	3.3	19.4	14.5	3.3	
1933	No...	1,352	40	331	425	100	2,238
	%..	60.3	1.96	14.7	19.0	4.5	
1934	No...	1,439	40	438	582	168	2,667
	%..	54.0	1.5	16.3	21.8	6.3	
Total	No...	5,012	212	1,419	1,512	361	8.517
	%..	59.0	2.5	16.6	17.7	4.25	
Women							
1931	No...	1	1	0	0	0	2
	%..	50.0	50.0	0	0	0	
1932	No...	2	0	1	1	0	4
	%..	50.0	0	25.0	25.0	0	
1933	No...	3	0	0	0	2	5
	%..	60.0	0	0	0	40.0	
1934	No...	3	0	1	2	0	6
	%..	50.0	0	16.6	33.4	0	
Total	No...	9	1	2	3	2	17
	%..	53.0	5.87	11.8	17.6	11.8	
Total Men and Women							
1931	No...	1,122	71	296	231	29	1,749
	%..	63.7	4.03	16.8	13.1	1.65	
1932	No...	1,103	62	355	275	64	1,859
	%..	59.2	3.33	19.0	14.6	3.45	
1933	No...	1,355	40	331	425	102	2,243
	%..	60.5	1.78	14.7	18.9	4.55	
1934	No...	1,442	40	439	584	168	2,673
	%..	54.1	1.5	16.4	21.9	6.3	
Total	No...	5,022	213	1,421	1,515	363	8,524
	%..	59.0	2.5	16.7	18.5	4.26	

Engineering by Departments (Men)

		Satisfactory Placements	Teaching	Stop-Gap Placements	Un-employed	Post Graduates	Total
Electrical							
1931	No...	339	21	110	74	7	551
	%..	61.6	3.7	20.0	13.4	1.3	
1932	No...	291	24	135	73	28	551
	%..	53.0	4.4	24.2	13.3	5.1	
1933	No...	264	8	109	72	22	475
	%..	55.5	1.8	30.0	15.1	4.7	
1934	No...	300	6	124	121	47	598
	%..	50.3	1.0	20.6	20.3	7.8	
Total	No...	1,194	59	478	340	106	2,175
	%..	55.0	2.5	22.0	15.6	4.9	
Mechanical							
1931	No...	219	20	41	62	4	346
	%..	63.4	5.8	11.8	17.9	1.1	
1932	No...	224	11	63	73	8	379
	%..	59.2	2.9	16.6	19.2	2.1	
1933	No...	244	6	73	89	1	413
	%..	59.3	1.4	17.6	21.5	.2	
1934	No...	274	6	71	108	13	472
	%..	58.1	1.2	15.0	23.0	2.7	
Total	No...	961	43	248	332	26	1,610
	%..	59.6	2.7	15.4	20.7	1.6	
Civil							
1931	No...	301	11	81	53	1	457
	%..	66.2	2.4	17.7	11.5	.2	
1932	No...	264	8	80	66	8	426
	%..	62.1	1.8	18.8	15.5	1.8	
1933	No...	217	7	78	82	7	392
	%..	55.4	1.8	20.0	21.0	1.8	
1934	No...	192	2	90	107	17	408
	%..	47.5	.5	22.0	28.8	4.2	
Total	No...	974	28	329	308	33	1,683
	%..	57.7	1.6	19.5	18.3	1.9	

Engineering by Departments (Men)

	Satisfactory Placements	Teaching	Stop-Gap Placements	Unemployed	Post Graduates	Total
Chemical						
1931 No...	46	2	10	10	6	74
%..	62.0	2.7	13.5	13.5	8.8	
1932 No...	65	3	16	12	12	108
%..	60.0	2.8	14.8	11.1	11.1	
1933 No...	64	3	10	17	9	103
%..	62.0	2.9	9.8	16.5	8.7	
1934 No...	73	2	14	25	20	134
%..	54.5	1.5	10.4	18.7	14.8	
Total No...	248	10	50	64	47	419
%..	59.0	2.4	11.9	15.3	11.2	
	61.5	2.9	18.6	9.6	7.2	
**Special Engineering*						
1931 No...	24	5	8	8	2	47
%..	51.0	10.6	17.0	17.0	4.4	
1932 No...	59	5	7	7	3	81
%..	73.0	6.2	8.6	8.6	3.6	
1933 No...	87	2	7	19	9	124
%..	70.0	1.6	5.7	15.5	7.2	
1934 No...	119	4	15	47	7	192
%..	62.5	2.0	7.6	24.5	3.4	
Total No...	289	16	37	81	21	444
%..	65.0	3.6	8.4	18.3	4.7	

* Special Engineering includes those departments that have very small totals, such as, mining, metallurgical, commercial engineering, etc.

Conclusions

It is interesting to note that the so-called "forgotten generations" are gradually being absorbed in industry. Also the relatively small percentage of unemployed is encouraging.

The placement of college graduates by years indicates that the classes of 1931, 1932 and 1933 are rather consistently placed to the extent of approximately 60 per cent. In the class of 1934, however, only 54 per cent of the graduates have been placed. This would seem to indicate that the earlier classes have to a certain ex-

tent made contacts and established their own jobs without the aid of the colleges.

It is also interesting to note that graduates in Engineering and in Business have been more satisfactorily placed than graduates in Arts and Science. This is probably due to the fact that industry demands some specific usable training from their new college employees. This is also borne out by the fact that a much higher percentage of graduates in Arts and Science are taking graduate work in an effort to prepare themselves for their future jobs than are the graduates of Engineering and Business.

Apparently men graduates are much more useful to industry than women, as 57.2 per cent of all men seem to be satisfactorily placed against slightly over 36 per cent in the case of women. As would be expected, the teaching profession is apparently absorbing a much higher percentage of women than of men which to a certain extent discounts the difference in satisfactory placements.

The following is a list of colleges that supplied useful information for this survey:

Antioch College
Ala. Poly. Inst.
Calif. Inst. of Tech.
Carnegie Inst. of Tech.
Columbia Univ.
Ga. School of Tech.
Harvard Eng. School
Iowa State College
Johns Hopkins Univ.
Kansas State College
Lafayette College
Lehigh Univ.
Mass. Inst. of Tech.
Ohio State Univ.
Oregon State College
Princeton Univ.
Purdue Univ.
Rensselaer Poly. Inst.
Rose Poly. Inst.
Washington State College
Stevens Inst. of Tech.
Syracuse Univ.
Tulane Univ.
Union College
Univ. of Ariz.
Univ. of Ark.
Univ. of Cin.
Univ. of Colo.
Univ. of Idaho
Univ. of Ill.
Univ. of Iowa
Univ. of Kansas
Univ. of Ky.
Univ. of Maine
Univ. of Mo.
Univ. of Nebr.
Univ. of N. H.
Univ. of Penn.
Univ. of So. Calif.
Univ. of Wash.
Univ. of Wis.
Va. Mil. Inst.
Washington Univ.
Worcester Poly. Inst.
Middlebury College
Colgate Univ.
Boston Univ.
Oberlin College
Indiana Univ.
Cornell Univ.

PREPARATION FOR SEEKING EMPLOYMENT

By HOWARD LEE DAVIS

Director of Technical Employment and Training, New York Telephone Company

One of the masters of a large New England preparatory school tells that when he was in college, he and a couple of other sophomores broke the strict non-hazing rules by putting some freshmen through their paces. A few days later they all received identical letters, instructing them to present themselves at the faculty room at a time which was half an hour after the next faculty meeting was to begin. Mature deliberation led them to believe that all was known. However, with some faint flickerings of hope, they decided their only chance lay in silence. Punctually at the appointed time they knocked upon the faculty door and were admitted. Their leader stepped forward and solemnly said: "Gentlemen, we have nothing to say!" The professors looked up in surprise and one of them replied, "Neither have we!" whereupon the sophs piled out of the room and into the arms of waiting classmates, some of whom had sat up a good part of one night learning to imitate the signature of the secretary of the faculty.

You may wonder what this story has to do with employment. Gentlemen, it has a very great deal to do with our subject. It illustrates the most fundamental of its fundamentals. No man who offers a tangible physical product for sale would dream of seeking a sales interview before he had learned all he reasonably could learn about his subject and had thus acquired ability to create customer interest. That applies with equal force to such semi-intangibles as life insurance and bonds.

Now when each one of your product calls at the offices of business and industry he is a salesman, even though he seldom seems to realize that. Thus your graduates are very poor salesmen of themselves, whereas many have helped to put themselves through college by good salesmanship of more tangible products.

Surely the aptness of our hazing story is apparent. When your products come to our offices in search of employment they have "nothing to say!" And, gentlemen, for the most part, in these days, "neither have we!" Employers are purchasing agents now. They are pretty well stocked up with employees. Some of them are open to salesmanship, though, and I could cite a number of cases where men whom I have trained in the fundamentals of preparation for job-seeking have secured jobs that did not exist before those men created employer demand. But when one of your graduates makes little or no preparation for the employment interview, when he relaxes comfortably and hopefully across the desk from an em-

ployer and waits for that employer to dig out of him some information that will lead to the offer of a job, then your product is not a salesman. He is another purchasing agent. And when two purchasing agents get together for a talk, is there any real prospect of a sale? This applies of course to all job-seekers, no matter what courses they took in college, and no matter whether they ever went to college.

You teachers and we industrial members of this Society have long believed that the colleges and technical schools should concentrate on teaching fundamentals, with a minimum of frills. It is fitting, therefore, that we should begin our discussion with a consideration of its fundamentals. What are these fundamentals?

Fundamentals

Every job-seeker is a salesman. He seeks to be paid for services. Therefore he is trying, actively or passively, to sell his services. He may be a good or a poor salesman. His chances of making a sale depend upon the extent to which an employer believes those services would be of value in his business.

The job-seeker should know what he is trying to sell. In the University of North Carolina Tar Heel Topics I saw, not long ago, a cartoon entitled: "Always the Optimist." A graduate in cap and gown with a sheepskin under his arm stood outside the office gate. An office boy was telling the boss: "A feller outside says he has an appointment with you." The boss, whose head represented the world, continued to work busily at his desk and replied: "Yeah . . . ? Ask him what he has to sell!"

Everyone can do many things. Some services are worth more than others. Every applicant should have in mind the type of his possible services that should be most salable to that concern.

You teachers are engaged in training brains. Presumably each of your graduates is mainly interested in a life occupation that requires more brains than muscle. Hand skill and muscle may be needed in the early training jobs, but the goal of most college men is the sale of brain power. Of course, personality, willingness to work, ability to get along well with other people, and other factors, enter into the employer's problem of whether to hire or not to hire, but all else is as sounding brass and tinkling cymbals without evidence of brain power and ability to apply it. Practically the entire employment interview centers on the problem of brains—what they contain, how they will function, and on what they should function profitably.

We enjoy doing those things we can do well. Of course the converse is equally true. We readily start and easily continue work in

which we are interested. We put off doing work that has less interest for us. Thus we are apt to be better informed and more skilled in matters that have a major interest. We read of them. We talk of them. When relaxed we often receive helpful flashes about them. Such "inspirations" are not so apt to come to us regarding uninteresting or distasteful matters that we shut away in our desks with relief at the close of the working day.

A job-seeker's most vital personal problem is to get a job well suited to his interests and abilities. All the job-seekers with whom I have discussed this fundamental agree at once that it is vitally necessary for them to secure employment. Some are not so sure that it is worth the thought and effort that would be necessary to determine upon that group of activities which would be most suited to their interests and abilities. Ninety-nine and forty-four one-hundredths per cent of them have never analyzed their interests. And I did not say one hundred per cent because I was trained as an engineer and have a wholesome respect for a factor of safety.

There is too much of the easy-going idea that a good man can succeed anywhere. Of course every man should believe in himself. But a man may be pretty good in many things and very good in a more restricted field. Because a certain individual is a good athletic coach, the college athletic authorities are not willing to place him in any coaching job that may be open—crew, football, track or any other team. Every job-seeker should determine: "Where is my most fertile field?"

The most effective way for a job-seeker to convince a prospective employer that he would be an efficient employee is for the job-seeker to demonstrate thorough consideration and execution of his own personally important job-hunting problem. It seems needless to emphasize that demonstration of a good product is an important factor in salesmanship. Employers seek evidence that will assist them to make their decisions. Demonstrations are more effective than assertions.

There is no exact science of judging people. We employers do the best we can to become expert in our jobs. But experts are not infallible. At least we know we are not infallible when the expert opinion concerns the working of the human mind. Therefore, men seeking employment should share in their placement problems and not leave their fates so completely in the hands of employers.

Everyone can look back at some decision he made six months, a year, or more ago and say to himself, if I had known then all that I know now, I would have made a somewhat different decision from the one I then made. Everyone is forced to make decisions by certain specific times. We must base those decisions upon all the facts, experience, opinions, and judgment that can be brought to bear

upon the problems at the times the decisions must be made. No one can do more. When we do less, we are gambling.

Many a man who has bought or rented a house has had it on his hands when business has necessitated a move to another city. But we continue to select homes. We are not satisfied to leave that decision to another by saying: "We cannot tell what may happen during the next few years, so let's just ask the real estate agent to select for us any house that comes within our means and that he thinks will suit our needs and tastes, and we will put up with whatever inconveniences we find there after we have moved in." And we continue to study over our business problems even though we cannot look into a crystal ball and accurately determine every future complication.

All this applies with equal force to the job-hunting problem. Probably everyone will miss perfection. A few months or a few years after he secures employment, a man may say: "If I had known as much about myself then as I know now, and if I had known then how this business would change, I would have tried hard to secure different employment." But he could not wait. His own best interests demanded that he make the best decision possible at that time, based upon the available data and advice, as well as upon his own judgment. Having done that, he would not be justified in blaming himself, no matter what happened later.

A man does not need to be a genius to obtain a satisfactory answer to this vital problem. Alexander Hamilton said: "Men give me some credit for genius. All the genius I have lies in this: When I have a subject in hand, I study it profoundly. Day and night it is before me. I explore it in all its bearings. My mind becomes pervaded with it. Then the efforts that I make are what people are pleased to call the fruits of genius. It is the fruit of labor and thought."

We have established these fundamental principles:

Every job-seeker is a salesman.

Successful salesmen understand the products they offer for sale.

A man is happiest when doing things he wants to do. Interest is the spice of the job.

He should have the best chance to succeed if he is engaged in an activity which has a major interest for him.

The job-seeker's problem of securing employment which is the nearest practicable to that which is most suitable for him, is one of the most vital problems that he has at that time.

The most effective way for a job-seeker to impress a prospective employer with his ability to do satisfactory work is for him to demonstrate thorough consideration and execution of his own personally important job-hunting problem.

The employer has no sure means of classifying the job-seeker and placing him in work most suitable to him. The job-seeker should share fully in that determination.

During his lifetime every person must make decisions that are based upon incomplete data. He must do the best he can with such information as is available at the time each decision must be made. The more complete the data and his consideration of it, the better should be the decision.

The Method

The complexity of any problem is considerably decreased for one who understands the basic principles needed for its solution, provided he has the will to apply those principles in an orderly and an energetic way. Let us now formulate a very simple method of preparing to secure satisfactory employment, with due consideration for those fundamental principles which we have established.

Every man should first study himself. He can start by asking himself: If I were told that I could have any work I wished, commensurate with my education, experience and ability, for what sort of a job would I ask? That is not a simple question. It would not be sufficient, for example, for him to say that he wants to be a salesman. Salesmen should know a good deal about the things they try to sell. A star salesman is usually better acquainted with his products, his territory, and with everything else that tends to assist him to get orders, than are the other salesmen with whom he competes. That means that probably he is much interested in all those things. It is relatively easy for him to accumulate and to remember all that information. It means also that probably he has the competitive spirit. He gets a big kick out of winning when the odds seemed greatly against him. But, with all his competitive spirit, probably he would be less successful if he tried to sell products in which he lacked confidence or which were boringly uninteresting to him. Therefore he would have to determine what group of things he could probably sell to the best advantage. He might tend strongly toward any one of machinery, oil, jewelry, real estate, bonds, or textiles, and away from all the others.

It would not be sufficient for him to determine that he wishes to be an accountant. For what would he like to account? If he is to be more than a routine bookkeeper, he must have a good grasp upon the essentials of the transactions for which he does the accounting. In order to rise to an influential position, he must have a real, not merely a mechanical, interest in the problems of the business. Probably he will have little difficulty in eliminating many types of business after little consideration. The real problem will be to determine upon a relatively small number of preferred prospects.

He will be helped in this study of himself by a careful consideration of published methods of self-analysis; also by seeking a personal vocational analysis from one or more experts. By these and any other methods that appeal to him, he can determine those few activities that seem to have the most interest, for which he seems best fitted, and in which, therefore, he should be most contented and most successful. He should consider himself to be in the position of a tourist in the West, who found at the beginning of a piece of poor road a sign reading: "Traveler, choose your rut carefully. You will be in it for the next thirty-five miles!" Thirty-five miles—thirty-five years; which deserve the more serious consideration?

Next, he should determine where his preferred type of work is done. He should select a few good concerns, with which he would prefer to be associated and with which he has reason to believe he may be able to secure employment.

He is now ready to prepare himself actively for his first sales interview. He should learn as much as he thinks he needs to know about the first concern to which he is to apply for employment. What is the scope of its activities? Where are its factories? Who are its main customers? Who are its competitors? Upon what patents, if any, does it depend? What territories, domestic and foreign, does it serve? The answers to these and other questions may be obtained readily from company sales literature, from financial manuals and company annual reports in stock brokers' offices, as well as from reference librarians. Encyclopedias will give him much interesting information about the products in which the concern deals.

During this preparation for the interview, the job-seeker should be constantly on the alert to discover the answer to the question, How can I best serve that concern?

This preparation is directly beneficial to the job-seeker in two ways:

It helps him to make a better impression upon the employer. Thus it should assist him to secure employment more readily. This is so because few applicants prepare themselves for an employment interview. The job-seeker who is prepared gets into a class by himself. The employer quickly discovers that he is unusual. This discovery is assured when the applicant asks meaty questions for which he has been unable to secure answers during his preparation. If there is a job for which the employer would otherwise include him as a candidate along with a few others, the increased interest that he arouses in the employer will probably give him preference over those other candidates.

When he secures employment he is more apt to be placed in work which at least approximates the type of work which he prefers. This follows naturally because in his preparation he has gained a general idea of the activities of that concern.

From those activities he has tentatively selected the ones that seem most interesting to him—those in which he believes he can best serve the concern. If he is a square peg, this information helps him to avoid being placed in a round hole.

When he is confident that his preparation is complete, the job-hunter should secure the opportunity to make a personal application for employment. He is reasonably well acquainted with his subject. He is ready to be asked, "Why do you apply to us for employment? In general, what sort of work would you like to do, if I give you a job?" He has done the best that he could up to that time to prepare to sell his services to that employer.

It is now and has been for some years past difficult to secure an opportunity to be asked these and similar questions by an employer. It is a waste of time and a wasted opportunity to be unable to answer them. Disraeli said: "The secret of success in life is for a man to be ready for his opportunity when it comes." The job-seeker's opportunity is the employment interview. He should be ready for it.

It is true that, even after this careful preparation, a man may not be able to secure the type of work that he desires. He should then seek the same type of work with a different concern, or prepare himself to apply for work that in some way approximates that of his first choice.

He may be forced at last to secure work that has no connection with his main preferences. That work would then be frankly temporary. At least he would have the distinct advantage of knowing what he wants. It would not be necessary for him to wonder whether he could adapt himself to every possible opening that comes to his attention. He can tell his friends about the work he wants. He and they will be receptive to all such possibilities. He may avoid a number of false moves. Some day he should secure employment that at least approximates his main desires.

What Is Being Done?

Now what is being done by those who are looking for work? Do any considerable number of employment seekers prepare themselves before they write letters of application, apply at offices for employment, or ask their friends if they know where there are any jobs open? The testimony of a good many of us employers says: "No; applicants give evidence of little or no preparation."

In some parts of the country it is a maxim that the farmer profits most by sending all his produce to market on its own feet. All grains and grasses are consumed on the farm and driven to market alive.

Gentlemen, a large part of your college and technical school product is not going to market on its own feet. It is asking others to carry it. It is willing to place itself in the hands of almost any employer who will give it a job—any job.

Here are a few excerpts from a large number of letters of application. The italics are mine:

The position I am applying for depends upon where *you* think I will best fit into your organization.

It is my desire to get an opportunity to work for your organization *in any capacity you may think fit.*

I am willing to accept *any job* you may offer me, providing that this job will serve to open the way for a bigger and more responsible position.

If there should be a possibility of an opening *in any department* of your company, I would be glad to furnish references or to come to see you for an interview.

Kindly file my name as applicant for *any position that may occur* for which I may qualify. I am willing to work immediately at anything legitimate (no canvassing) at a moderate salary.

I feel competent in *undertaking anything* that you may see fit to give me.

I am ready to consider *any* opening.

This is not limited to men seeking their first jobs. A typical case was that of an older young man who came in to see me the other day. He had been six years in his present job. He still held it, but wanted to change. Wasn't interested in what he was doing. Couldn't see anything he cared for in the higher positions. Wanted to get in work that interested him and promised a better future. Said six years should be long enough to try out a job. "What sort of work would you like to do for us?" I asked. Then came that usual answer: "Any work in which you think I'll fit. I'll work hard and I'm sure I'll succeed." He admitted that his employer had made a mistake in putting him in his present job. He was still willing to rely on the sole judgment of any other employer.

What would you think if a man who had taken a variety of subjects in college applied to you for a job by saying: "In your college I shall be glad to teach any course that you are willing to entrust to me and for which you will give me a steady income?" I know the cases are not strictly comparable. I believe that both the man and the employer find greater difficulty in being reasonably sure that the man is advantageously placed in the business world.

An employer may be willing to start a man in "any sort of

work" if he feels the man would do well in one of the more important positions when an opening occurs. Preparation for the interview assists the applicant to create that favorable impression on the employer. I have in mind a young engineer who served as night watchman and was put on laboratory work during busy periods. As the technical work increased, he became a full-time laboratory employee.

Most applicants demonstrate their lack of thoughtful consideration of their own problem when they answer one of the first questions asked of them. Usually the fatal question is our old friend: "What sort of a job would you prefer to have if I were able to give you any job for which you ask?" A blank look possesses the faces of many applicants when this question is asked. It tells the story that such an idea is totally new to them. Many answer, "I would like to have any job that has good prospects for the future." They soon agree that probably every job in a good concern has prospects. After that they struggle with this new thought. An oft-recurring answer is: "I would like to have a position of responsibility, in which I can direct other men." The natural answering question of the employer is: "In what general sort of business activity do you think that you would have the best opportunity, in competition with other aspirants for promotion, to attain that position of authority?"

One man who wrote a request for an interview said, "I wish to emphasize that I am willing to undertake any position which you may be able to offer me, and I know I can render my employer as great a service as he is rendering me by giving me the opportunity." The willingness was apparent—the willingness to work and also the willingness to place himself entirely in the hands of anyone in the company who had a job to fill. He wanted a job—any job.

That willingness to take a chance rather than to make the effort to think the problem through is, undoubtedly, responsible for another statement that is made by many applicants. It is: "In your concern I am sure I can find work in which I will be interested." They drift from one office to another. Wherever they happen to seek employment they expect "to find work in which they will be interested." They are equally confident everywhere. They seem to believe they will be allowed to shift around in the organization until they find some general variety of work that interests them.

Most applicants readily agree that they are salesmen. When asked what they are trying to sell, they look off into space and the usual reply is, "Myself, my education." They catch the point when reminded that "yourself" is too general and that all applicants have education. Each one is just a grain of sugar in the sugar barrel. Each needs stimulation to get into a package with his own name attractively placed on the outside.

At this point I have asked: "Did you ever sell anything?" Nearly all have. Here is a typical case. He replied: "Yes, I sold vacuum cleaners for several months last year." "Good," I said, "Now just as soon as you got that job, I suppose you started right out to make a sale. At the first house, did you say, in effect: 'Mrs. Webster, please buy this vacuum cleaner. I am sure it is a good cleaner. Probably you know more than I do about the uses for these attachments that go with the machine. If you will use this cleaner on work for which *you* think it is suitable, I am sure you will be well satisfied with it.'" "No, sir," was his answer, "of course not. That seems ridiculous, doesn't it? First I had to study my own vacuum cleaner and all its competitors. Then I studied the best ways to interest people in that method of cleaning and in our cleaner in particular. After that I started out to sell—and believe me, the going was tough enough, even after those preparations."

Yet that is just what your graduates do when they seek to sell their services. Is it not clear that we have before us a paradox? The job-seeker endeavors to sell the use of his brains, but he does little or nothing to determine and to demonstrate how and where they would be of greatest value. When this has been made clear, some applicants say: "I could talk and talk about articles I have sold. I seem to have nothing to say that will sell myself."

And so practically all of your graduates passively offer their time for sale to almost any casual purchaser. They continue merely to display the simplest of their wares: apparent personality, education, school teams, past jobs. But, not knowing what they are trying to sell, they patiently wait for questions, hoping their answers to such questions will somehow impress the employer favorably and that he will give them jobs—almost any jobs.

No matter what the applicant says, his attitude and what he does say boil down to: "Mr. Employer, you know more about me than I know about myself. Please size me up and put me in a job that I will like, so that I will be interested to work hard and to do better than most of the others there with whom I shall have to compete for promotion." I have had applicants say and write almost those very words.

And, strange to say, lack of salesmanship extends even to mature men with considerable sales experience. The other day a salesman of a firm well known to all of you brought his son around in search of employment. I asked the son why he wanted a job with us and the father answered. All his reasons were of personal advantage to the son. He gave no hint of what either of them thought the boy could do best in return for his wage. That was to be entirely up to me. And yet that salesman father knew that he could

not sell the products of his firm unless he made someone believe they would be of service to him—of more service than similar products he could purchase.

Let me emphasize again that the applicant offers for sale the use of his brains, but he does not make full use of his brains in the solution of how best to sell them. Instead of applying to his own problem the methods he would have to apply to the problems of an employer, he lazily relies upon his belief in himself. If he reasons out the basis of his easy-going and non-directive efforts, he probably finds justification in his general confidence that he can adapt himself to practically any work that he can secure. Undoubtedly that is one reason why so many applicants ask for any job that is open. One letter of application, after asking for work in any one of a wide variety of occupations, ended with: "or any other job that you may have on hand." Jobs to him were so much merchandise; any food would do, as long as he secured a meal ticket.

As the employer thus receives little or no help from his applicant, he must rely almost solely upon his own ability to judge his capabilities. We have seen that the employer is not guided in that by any exact science. The employer knows he makes mistakes and therefore he is ever on the alert for anything that will verify or contradict his impressions, or that will enlighten him in any way. It is no easy task for an employer to satisfy himself as to which of a number of applicants would best do certain work and progress to higher levels. It is particularly difficult when all the applicants have given comparatively little thought to their own problems—when no one of them has done much more than to state his age, education, and previous experience, and then makes almost no further contributions to the conversation, except to try to answer questions.

When an employer is seeking thus to make up his mind about an applicant, there are usually four major questions that occupy his mind. They are: Is there a good possibility that this man will like our work? Will he be sufficiently interested to do the work well and try to do it better? Will he develop so that more and more responsible work can be given to him as conditions change and more people are needed for the higher positions? Will this applicant be reasonably satisfied in the lower position that I have open now, until he is prepared for a better job and there is an opening to which he can be promoted?

And so, therefore, practically every employment man devotes a considerable portion of the employment interview to an effort to discover the natural interests, if any, of the applicant. Sometimes, by keen observation and questioning, the employer can help the applicant to discover more about himself. It must be remembered, however, that this is decidedly a buyer's market to-day in the em-

ployment field. The employer no longer needs, nor does he usually have the time, to help the applicant to make a thorough analysis of his major interests and abilities. The applicant who lacks the initiative and the go-getting qualities to analyze himself is not receiving much assistance from prospective employers. He loses an opportunity to strengthen whatever good impression he may otherwise have made. He loses an opportunity to demonstrate his ability to his hoped-for employer.

When an employer is about equally attracted by the personalities, education, and other essentials of two or more applicants, the job-seeker who has done the best to solve his own problems secures a distinct advantage over those who ask the employer to put them in any sort of job for which he thinks they are fitted.

Objections

What are the objections that are made to these methods? Some have received these ideas eagerly and have come or written back to tell how they have worked successfully. Some have expressed doubts. The objections most often made are: Business is complex. How can I know enough about it to be able to determine what sort of work I would ask for if I could have any job I want? I can not see the use of doing all that work in order to determine what I would like best to do. Is the first job important? It is so difficult to find a job anywhere—does not a fellow have to take any job he can get? He can not be too fussy! This last objection may be true, after he has done what he can to secure the work that he wants most, or later, some other work that as closely as practicable resembles the job he really prefers. Remember the fundamental we established that, even though a person may know he cannot be sure he is making a perfect decision, he is not justified in neglecting to gather all the facts and opinions he reasonably can accumulate by the time the decision must be made. Remember that, otherwise, he himself will not be in a position to recognize his real opportunity if it comes his way. Remember that his friends can serve him well only if they know what he desires.

Do Employers Expect This?

This naturally leads to the questions: Do employers expect job-seekers to have given comprehensive consideration to their job-hunting problem? Are applicants actively penalized in the minds of employers when it becomes evident that they have failed to prepare themselves for the interview? With few exceptions, the answer to both of those questions is, No. That is because so few applicants have thought this through from their own or the em-

ployer's point of view. Therefore, employers have little opportunity to make such comparisons between their applicants.

Again, that is where the prepared job-seeker has his big advantage. That is one of his best opportunities to get in a class practically by himself by arousing increased interest in the mind of the employer. He does not allow himself to be classed with the general run of the unprepared, who merely seek any sort of a job that will put them on a payroll. He refuses to leave all to the chance that some employer will take a fancy to him somehow or other—he knows not how.

Now I am not raising my voice in lamentations because I receive so little assistance from those who apply to me for jobs. Far from that! For many years we employers have been so accustomed to having applicants leave practically the whole solution of their problems to us that we have accepted the conditions as a matter of course. When we have jobs to fill, we do not take time to impress these truths upon those we can employ. We are salesmen then, not purchasing agents. We appraise the applicants, by digging out of them such information as we need. If, during that process, we believe a man to be fitted for a general type of work in which we have an opening, we describe that work—we sell it to him. Undoubtedly we underestimate some who hide their lights under many bushels. No, I am not seeking assistance for employers. I am urging you to enlighten your students in order that they may more fully join employers in the consideration of their own futures.

What Can You Do?

This is where you teachers can come in strong by getting these and similar ideas across to your undergraduates, not later than junior year. Help them to discover the most fertile fields for their endeavors. Teach them to guide their broad and hopeful generalities into more specific channels. Some of you, I know, are doing good work along these lines. Professor Bangs of Cornell starts to give these ideas to his sophomores in Administrative Engineering. He says that is none too early and I think he is right. These and other business ideas are given to all Electrical and Mechanical seniors at Cornell in a special course entitled "Introduction to Business and Industry" of which Professor Bangs wrote an article, bearing that title, in the November 1932 issue of the JOURNAL OF ENGINEERING EDUCATION. Similar instruction is offered at M. I. T., Yale, Purdue, and other institutions. This is your own fertile field for giving a final directive touch to your educational endeavors.

I have been asked many times: "Why don't they tell us this while we are in college? This information would have been of

great help to me." Then I defend you. I tell them that the schools are not obligated to get their graduates jobs nor to train them in the technique of preparing to seek employment. But do you want that defense? Would not you like to feel that you don't need it? And, gentlemen, it is getting more difficult to put up this defense. Personally, however, I regard this as your opportunity, not as your duty. And this fits in so naturally with your technical teaching. You teach your students the engineering method as applied to engineering projects; to gather all available data, to analyze that data, to consider probabilities and possibilities, to seek suggestions and opinions from those who are acquainted with various phases of the subject, to consider their problems thoroughly before they formulate their own definite engineering recommendations. I am urging you to train your students to apply those engineering methods to their own personally vital problem of preparing to make the best start possible in their business careers. They may not do a perfect job. It is not so easy to apply a comfortable factor of safety to this problem. But the better job they do, the better the progress they will enjoy. The lack of assurance that their decision will be perfect is no justification for lack of effort.

Of course you will want to impress upon your pupils that no one is so universally gifted that he can excel in everything he may try to do. That those who are really successful have concentrated on certain major activities. That they may be able to do rather well in a number of other activities when occasion demands, but they are consulted most about their own specialties.

As a matter of fact, most people do have one or more interests that are much more absorbing to them than are any others. The difficulty is that they have not taken the time and made the directive effort to recognize them and to figure out how those interests may be made useful and therefore personally profitable in business.

Of course some people have no real major aptitudes; therefore they cannot make this discovery. Many recognize those major abilities when it is too late to secure the greatest benefits from them. Those who discover them early are repaid by increased personal satisfaction, together with greater and more stable income.

And undoubtedly you will want to emphasize that it is not sufficient for an applicant to believe vaguely that he has some certain set of main interests. He will be asked what he has done about them. He must realize that everything he says in the employment interview opens up to the employer an interesting avenue for further questions. One applicant professed to me an intense interest in writing advertising material. His statement carried little weight, however, when he had no originally written ads of his own

to show and said he had never tried to write any. Furthermore, he was doing nothing toward learning how to write them.

You have noted, of course, that I am not suggesting any standardized method of approach to or wording for the employment interview. I am emphasizing the great advantage that accrues to the applicant who has made the best practicable analysis of his own interests and abilities, who has prepared, and is therefore ready to adapt himself to the personality of his interviewer and to any trends that may develop during the interview. We have seen that this lack of thoughtful preparation is general among those seeking employment. It is not limited to those who have just graduated from school. When you have enlightened your students they will have a great advantage over most other job-seekers. Some day, when these and similar methods are better understood, employers will rate down those who do not adequately prepare themselves for seeking employment.

Of course every activity must be headed up somewhere, if it is to be effective. Maybe your personnel people are not represented here. If not, I hope I have made the existing conditions so clear to you that you will be an earnest advocate for more action on the part of those who have the duty of preparing your undergraduates for the transition from school to business. But that is not enough. This should not be left to one shall group. We all know that the best results are not achieved by any alemite gun process. Make this one of your problems in the teaching of the engineering method. Prepare your men for the competition, so that in their future employment they may come as near as practicable to that which is most suitable for them.

EMPLOYMENT IN SMALL INDUSTRIES

By C. H. CASBERG

University of Illinois

Colonel Crosby Field in a recent publication stated that he likes a small plant for the following reasons:

1. It is a way of living that affords more opportunity for the individual engineer to become an integral part of the management and to share in the rewards usually forthcoming to management and frequently those belonging to ownership.

2. Normally it permits a greater versatility of activity and consequent broadening of viewpoint and practice of technique in an ever-widening number of lines. It correlates cause and effect; action and profit or loss; ideas and stability with a shocking suddenness foreign to the larger or-

ganization. It demonstrates that although inertia may wipe out the effects of small economic bumps, quick thinking and quicker action alone can carry over a major depression.

3. I like a small plant because authority and responsibility are automatically coördinated without an organization chart, because there is less opportunity for the "side show" to pocket the interest of the "main tent," because the owner-stockholder as well as the most unskilled laborer are both real people, not abstract classes, and because all the problems technical and human, are real and readily seen without the necessity of a thought-hiding report in written words. A small plant is still big enough to have all the problems of finance, sales and promotion, and yet small enough to make each executive cognizant of the effects of any problem on all phases of the business.

Colonel Crosby Field with all his enthusiasm for small industrial enterprises advises the young engineer to start his career with a large industry and to resist the many influences of the large industry to narrow the young engineer into a useful cog for its benefit.

As to the need of the small industries for engineering graduates there is no doubt. Design problems and processes of manufacturing have become quite technical and at least one college trained engineer can be used by most small industries. The writer knows of one small prosperous industry that seemed to take great pride in being able to prosper without the aid of any college men. As time went on the specifications for the heat treatment of parts which this company made for the automotive industry required the use of pyrometers and the company was compelled to hire a chemical engineering graduate to supervise the temperature control of their furnaces.

In the history of most small industries where the owners or the management have avoided employing engineering graduates for some reason or other, an occasion usually arises such as mentioned above which made it necessary to employ engineering graduates. But if the young engineer is employed by a small plant directly upon being graduated, he is very often at a disadvantage if there is nothing he can do at once to make himself useful to his employer. The large industries know the limitations of an engineering graduate just out of college, and provide training courses and jobs that make the young engineer feel that he is doing something useful. Some of the smaller industries do not know the limitations of the young engineering graduate and before he has adjusted himself to his surroundings the employer becomes disappointed and the young engineer discouraged. The employer and the young engineer both should be coached for this adjustment period and it seems that this job of coaching could be done best by a representative from an engineering college, such as Purdue University uses in their set up for looking after their young graduates.

There are plenty of jobs in the small industries that an engineering graduate can do. William G. Christie, Smoke Abatement Engineer, Jersey City, says: "My own work has brought me into close contact with small plants for a number of years. I refer to small manufacturing plants, laundries, commercial buildings, apartments, etc. Such plants are carelessly operated and almost unbe-

TABLE 1

GEOGRAPHIC DISTRIBUTION

	Class													Total
	'22	'23	'24	'25	'26	'27	'28	'29	'30	'31	'32	'33	'34	
Africa											1			1
Alaska									1					1
Arizona									1					1
Arkansas							1							1
California	3	2		1					1					7
Canada								1	2					3
Colorado									1					1
Connecticut	1		1			1		1						4
Honolulu									1					1
Illinois	19	22	16	15	18	9	19	12	15	22	28	30	26	251
Indiana	1			2	1	1	2	2	4	3	1	2	1	20
Iowa		2	1	1			1		1	1	2	1		10
Kansas							1				1			2
Kentucky									1				1	2
Massachusetts			1	1				1	1				1	5
Maryland	1	1	1	1								1		5
Michigan	1	3		2	2		1	3		1	3	1	3	20
Minnesota	1						1			1				3
Mississippi						1								1
Missouri		2	2				1		1	2	4	3	2	17
Montana								1						1
N. Carolina										1				1
N. Jersey	1	1					1		4				2	9
N. Mexico												1		1
New York	1	1	3	1		2	3		5	2	1	3	1	23
Ohio	1	3	4		2		2	4	1	1	2			20
Oklahoma								1						1
Oregon									1					1
Pennsylvania		1	2	1	2	1	1		2	1	2	2	1	16
Philippine Is	1	1												2
Texas				1			1			1	1			4
Virginia	1			1				1						3
Washington											2			2
Wash., D. C.			1	1							1		1	4
W. Virginia		1	1		1									3
Wisconsin	1	2	1		1	1		2	1	1	1	1		12
Not employed	2		2	1			1	3	1	4	5	9	8	36
Total	35	42	36	29	27	16	36	32	45	41	55	54	47	495

lievably inefficient." Some agency should bring the managements of small plants and the engineering graduates together for their mutual benefit, and perhaps this agency should be representatives of the engineering colleges.

During the past year Professor O. A. Leutwiler, Head of the Department of Mechanical Engineering, University of Illinois, made a survey of employment of mechanical engineering graduates for the 13-year period from June 1922 up to and including the class of 1934. During this period a total of 651 had been graduated. A questionnaire and a letter were mailed to each of the 651 graduates. The letter contained information that several employers had written to Professor Leutwiler stating that the employers were in need of services of mechanical engineering graduates. Under such circumstances, it is reasonable to suppose that the majority of the unemployed graduates would be interested and return the questionnaire and that the majority who did not answer the questionnaire were employed and not interested. Of the 651 questionnaires sent out, 495 were returned.

From Table No. 1 it can be seen that 251 or over half the graduates were employed in the state of Illinois, 23 in New York, and 20 each in the states of Indiana, Michigan, and Ohio. The remainder are located in 26 other states and other parts of the world.

Table No. 2 shows that 53 per cent of the 495 graduates are em-

TABLE 2

EMPLOYMENT OF MECHANICAL ENGINEERING GRADUATES
UNIVERSITY OF ILLINOIS

Class	Small Industries	Large Industries	Engineering Education	U. S. Government	Non-Engineering	Not Employed	Total Questionnaires Returned	Total Graduates
'22	9	17	0	1	6	2	35	54
'23	14	25	1	0	2	0	42	71
'24	17	11	1	2	3	2	36	60
'25	5	20	0	1	2	1	29	43
'26	8	15	2	0	2	0	27	41
'27	3	11	1	1	0	0	16	24
'28	10	20	4	1	0	1	36	43
'29	6	16	3	2	2	3	32	39
'30	13	25	1	3	1	1	44	55
'31	6	24	0	1	6	4	41	54
'32	10	32	0	1	7	5	55	59
'33	11	22	0	0	12	9	54	58
'34	11	25	0	1	3	8	48	50
Total	123	263	13	14	46	36	495	651
Per Cent of Questionnaires Returned	24.9	53.1	2.6	2.9	9.2	7.3	100.0	

ployed by the larger industries and approximately 25 per cent are employed by the smaller industries. These figures are significant in that they show that the smaller industries are employing nearly half as many of the graduates as the larger industries.

It is not wise to draw too many conclusions from a survey which includes only the mechanical engineering graduates from one institution, but the results show that the mechanical engineering graduates have ample opportunity for employment in the smaller industries. The opportunity for employment in the smaller industries for the electrical engineering graduates is probably not so good as that of the mechanical engineering graduates. It is hoped that a survey will be made in the near future that will include all the graduates of several larger engineering colleges and that some organization now in existence or some other agency will set up to bring the smaller industries and the engineering graduates together for their mutual benefit.

Discussion

John R. Bangs (Cornell University): Mr. Davis and I have been working together for some time, he as a representative of a large industry, and I as a teacher in mechanical engineering with part of my time devoted to placement work.

The statement Mr. Davis makes about employment and training I have found to be very true. The question of selection is indeed important. Not so long ago I heard a story pertaining to selection which I think may be interesting to you. It seems that the president of a medium-sized firm, who was a Yale man, was looking for someone for his organization, and he wrote to a friend of his own who had a number of college contacts, describing the type of men whom he wanted to employ. He said, "This man must have a splendid personality. He must be at least six feet tall, be a member of Tau Beta Pi, be a good engineer, perhaps be captain of the football team. In other words," he said, "I want a typical Yale man."

And his friend wrote back, "What you probably want is three Cornell men, or one Georgia Tech man part time."

In his textbook, "The Young Man in Business," Mr. Davis has one chapter on "Educating the Boss," which pertains to the problems of tact, coöperation, leadership, etc. I think he might have added, as one alumnus did, in speaking to our classes, "Select your boss with a good bit of care and if he doesn't make good, fire him." Perhaps that is a rather novel view of the selection problem.

I could speak at some length on the problem of selection because I consider it very important, but I will confine my remarks more or less to the work that we have been doing at Cornell.

We found out, as many of you have, that the average untrained college graduate has as much sense of direction as an egg beater. He usually does not know where he is going, he does not know how to analyze himself or how to analyze the industrial prospects that may exist. Consequently, in about 1931 we decided to do something about bridging this gap between the college on one side, and industry on the other. About this time Mr. Davis' book "The Young Man in Business" was published and we adopted this as a text for a lecture course. Mr. Davis accepted our invitation to come to Cornell and give these lectures to a group of about 150 mechanical and electrical engineers once every week during the first term. We called this course "Introduction to Business and Industry" and I will just give you a brief outline of the topics we discussed in this course.

There was, first of all, an introductory lecture by Dean Kimball, showing the need and demand for this work, just as it has been stressed here this morning. Later, Mr. Davis came and talked on the problems of "Selecting the Job," "Securing Employment," "Planning for the Future," "Preparation for Responsibility," "Organization, Supervision and Leadership." (These are chapters in his text.) Then we had one lecture by Director Diederichs on the problem of ethics, which was followed by a lecture by Mr. Davis' assistant, Mr. James H. Bigelow, on "The Specific Problem of Business Ethics and Engineering Ethics." The last lecture of the course was given by Dean Kimball, taking as his topic "The Content of a Liberal Education."

One of the interesting features of this lecture series was the "question box." We encouraged the students to hand in written questions concerning the subjects discussed by Mr. Davis at the beginning of the week. These were sent to him and he prepared elaborate and detailed answers to them. Questions such as "Should I go into a large company or a small company?," "How shall I select my first job?," "If I don't like my first job, what shall I do?" and other problems of a similar nature.

I must say before going further that I am more or less confessing rather than bragging. I am like the little girl who came to her mother and said, "Mother, Johnnie kissed me."

Mother said, "That is terrible, Mary, how many times did he kiss you?"

"Oh," said Mary, "Mother, I am confessing, I am not bragging."

I think that in relating our experience with this new work, Mr. Davis and I are confessing, not bragging. The first time we gave the course it was not an absolute success. We felt that there was something lacking, that some problems in connection with selection

and interviewing had not been covered and since we wished to make this course as thoroughly helpful to our students as we could, we decided to devote one lecture period to the demonstration method, the method made famous by Professor Elliott Dunlap Smith at Yale and by Professor F. Alexander Magoun at M. I. T.

I arranged the platform as an interviewing booth, with table and chairs, and asked Mr. Davis if he would come up there and conduct an interview. He said "Yes, if you will select three men. One may be a dumb-bell, but please put on also one Tau Beta, so that I will have something to work with." I selected three men, and gave Mr. Davis all the information that he would normally get in a recruiting interview. Then I went to the class and said, "This is an experiment. You must take this seriously. There should be no noise whatever. I want it quiet enough to hear a pin drop. This will be an opportunity for you to see an interview conducted by a master interviewer and you will have a privilege that will probably not come to you again until you have been out in business or industry for ten years."

The class coöperated splendidly. The three men came up and were interviewed, about ten or fifteen minutes being allowed for each man. At the end of the interviews, Mr. Davis kindly post-mortemed each man's little problem, showing wherein he had made mistakes and advising him for the future.

We felt that this demonstration covered some of the fine points of interviewing that could not have been pointed out in months of lecturing.

I should like to suggest, Mr. Chairman, that we make such a demonstration at our next meeting. Instead of talking about these problems, let us actually put a desk and chairs on the platform and let some of the Borings (M. M. Boring, General Electric Co.), the Davises (H. L. Davis, N. Y. Telephone Co.), the Colers (C. S. Coler, Westinghouse Electric & Mfg. Co.) and others show us how it is really done.

I have come to believe that we should begin before the senior year with this work of interviewing, or in preparing the students for what to expect. In the administrative engineering department I have a course called "Business and Industrial Management" where I begin this work. This is in the nature of a survey course and I have thrown in some of these personnel problems. I give several lectures, invite Mr. Davis to give several and then have the sophomores carefully and critically review "The Young Man in Business." By starting earlier, planting the seeds earlier, I believe that we are getting the story over a bit better. The senior lectures, of course, go on just the same.

We have criticized the college folks about not preparing their

men, and we have said that the average undergraduate has no sense of how to go about selecting his job. Now, let us look at the other side. All the interviewers who come to the colleges are not the Borings and Davises and Colers. They are not all master interviewers. In fact, I could write a small volume about some of the interviewers I have met. Not that we are not always very happy to see them, but we must recognize that they have their deficiencies as well as the boys. Some of them blow into the halls of learning and insist on booming out their propositions like the Lord Almighty speaking to Moses, never permitting the graduate to say a single word. In fact, I have known some of these interviewers to become pretty angry when the boys started to ask them questions. There is something to be done on that side and I think that the larger industries, particularly, have done a marvelous job. But, what about the smaller ones?

They are the new factor in the College Personnel situation. During the depression period our men have gone out and have found work with the smaller industries. The smaller industries have recognized the value of college men. They are now going to be thrown into the competitive picture, and if I am any judge of the situation at all, by 1937 or 1938, I think the colleges will have more of a problem in dealing with industrial organizations and interviewers than they had back in the boom days. What happens in the average small company? The president probably sends the secretary or treasurer or works manager, or perhaps production engineer, to certain colleges to select some of its graduates. If he is the average individual, as you and I, he thinks he knows all about selecting men because that is something we all know something about, at least we think we do. When he gets there he makes his selection—by the usual hunch methods. It is not such a happy combination, when you put together the graduate who is not trained and an interviewer who has not given very much thought to the problem. You have resulting a most inefficient situation.

Therefore, I say most heartily with Mr. Davis that we college teachers must train our men to protect themselves, to do a better job than they have done in the past. I visualize the smaller industries and some of the medium sized industries perhaps more or less ganging together. If, for example, five or six companies were represented by one man who made it his business to study interviewing and to study colleges, and if, for example, Mr. Interviewer of the "X" Company came to "Y" University, representing not one company, but five or six, he would receive a great deal more attention. The college problem would be greatly simplified, and most of the men could be placed or at least considered for positions in different companies. Mr. Interviewer could make a preliminary

selection, and then have the men go to the industries for final selection. I think in that way the industries would save money, they would get better men and the colleges would be able to operate their placement offices more efficiently.

We must look ahead. We must be prepared for this new interviewing day that is coming. In fact, we must keep very much on our toes. One of my graduates of some ten years back tells me that I am getting to be an old fogy and that I should get out every so often and do some work in order to appreciate what the problem is all about. Not so long ago he wrote me a letter and in it he enclosed this little story. He asked me this question:

"Are you a frog? A frog is a particularly daft creature. If it is put into a bowl of cold water, and the water is very slowly brought to the boiling point, the frog is so unconscious of the gradual change in its condition that it is boiled to death when, at any moment, it might have jumped out.

"So it is with many a business man," and, he says, "with many college teachers and personnel men. "I meet scores of them, so unaware of any changes in their condition, so obstinately unwilling to admit that there is any change that, as they die peacefully in their minds, so their jobs die imperceptibly, in sympathy.

"If you have any reason to suspect you are a frog, you may still get your chance to do a bit of hopping in 1936. Don't leave it too long. The water may soon come to a boil."

F. W. Slantz (Lafayette College): Instead of adding my personal experience testimony to the effectiveness of sure-fire methods of placing college graduates in jobs, I choose to present a consideration of limitations to some generally accepted practices. Not, I hope, in a spirit of criticism or pessimism but rather as a word of caution and conservatism.

1. While good scholarship and extra-curricular leadership are quite generally appreciated by employers; at least as an indication of future promise; are we not confronted with the fact that average or even mediocre college graduates can perform a respectable and valuable function? The placing of top notchers is no great problem. It will be readily admitted that high scholarship and abstract intelligence are not the only desirable requirements. "Personality" must be considered. Surely; but even that can be overstressed, especially as it cannot be defined clearly. If you are so fortunate as to be sure that you have only thoroughbreds in your stable, you need not concern yourself with willing work horses, but life's not made up entirely of race events. There must be a fair demand for less spectacular, steady pluggers.

What about the popular advice to young men concerning the writing of letters of application? We can insist upon correct

spelling, grammar, form, and content, but the letter must contain his ideas, even portraying his own lack of experience, in order to ring true. (One can have them written by a syndicate.) Does that reveal the true character or "personality" of the applicant? Does a studio portrait from which all character lines and natural imperfections have been removed, help or hinder in the final critical judgment? But it all depends on getting that first interview, you may say; why not use every device for bringing that about? In my estimation the follow-up is much more important. Too many men pass the first interview with flying colors only to lose out in the final test. How can we best cope with that problem?

The preliminary aids to self analysis are noted in Dr. Walter's paper. In these a student can be made not only to recognize his natural limitations, but to cultivate self-confidence and proper regard for his assets, such as they are, learning to bring these into the picture; this is a vital function in effective placement instruction. The young graduate must counter charges of lack of experience with the possibility of bringing young ideas and a fresh point of view into the organization.

A characteristic failing of engineers is the habit of presenting the facts good and bad in facing a problem. This sometimes results in underselling their own ability. But on the other hand, experienced employers know that such men usually take natural pride in getting things done in spite of difficulties. Applicants must not only know such arguments in their favor, but what is more important, they must have the confidence which comes from believing in themselves, even after disappointments. We, in placement work, must be ready to give them the resilient power to come back with fresh enthusiasm and perhaps a new vision.

I have neither time nor inclination to point out how important an orderly presentation of personal record and history of achievements is, in the written application. Any placement bureau worthy of support must insist upon a thorough training of its candidates in matters of record presentation. Another matter is frequently overlooked: It is the sources of leads and how to use them; this part of the placement procedure must be shared with applicants. Professional reports, newspapers, libraries, alumni connections and interests must be studied together. In short, the man to be placed, must be made to feel that the services of the bureau are a permanent part of his relations with the college—that the problem of placement is a coöperative enterprise in which the student, his professors, the placement officers and his own friends and relatives may share, in bringing about the consummation of his employment in the work which will continue to give him satisfaction.

It is vitally important to present to a college man the best policies for holding the job with credit to himself and to those who are interested in his success after he has it. I know of no more valuable and comprehensive treatment of this subject than "The Young Man in Business" by Howard Lee Davis. That is our bible and text book in this important part of guidance.

Finally, it is our duty to train young college men to observe a code of ethics in matters of employment. Take for example the matter of references. A boy must be impressed with the necessity of giving as references only those who know him. He must give them opportunity to refresh their memories about the details which are important for them to know about the applicant. He must give all available and correct information about the position which he is seeking; above all he must choose those who can be relied upon to write promptly. Service results from a simple observance of this code.

What is the fair and ethical thing to do when a senior is interested in several offers of employment? How can we advise and how can we reasonably control action unless we have all the information and the coöperation of department heads, employers and the candidate? The only way in which this is possible is through mutual respect and an appreciation of ethical conduct.

Vash Young who is, perhaps, the outstanding insurance salesman in the country today, has written a little booklet which he calls the "Go-Giver." His whole philosophy is based upon the idea of offering something of value; of considering himself entitled to a sincere welcome because he truly intends to give something well worth receiving. He has the courage to aspire to the best for himself because he believes in his own integrity.

There is considerable danger in overselling an individual on one particular opportunity because of the reaction which may set in, in case of a disappointment. Balanced judgment coupled with a sane understanding that the perfect niche in occupations is a myth, is an important part of a college man's vocational information. If we can keep alive a desire for intellectual adventure, of continuous education, the college man can adapt himself to the opportunities which he helps to create, and maintain religiously a wholesome attitude which is so closely related to aptitude and its successful application. Do we as executives recognize the letters of application by extending the courtesy of an initial reply?

R. C. Disque (Drexel Institute): I want to say one word in extension of what was said a moment ago about the other side of this picture. I think there is danger in attempting to standardize the methods of approaching employers and even trained personnel managers, for the very good reason that they themselves are not stand-

ardized. The approach that will make a very fine impression on one will make a very bad impression on another, and I sugest to you, on behalf of the young college graduate, that you may actually be misleading him in many cases if you give him too specific advice as to how to approach various kinds of people.

Consider, for example, the letters that Mr. Davis introduced. I know men in the business of employing college graduates who would be very favorably impressed by those very letters. In fact, I think there has been something of a propaganda in the past tending to create a very humble attitude on the part of the college graduate. Have we not heard a great deal in the past about the over-confidence of young college graduates who went out too ready to tell employers how much they could do? I venture to suggest that the humility shown in a good many of these letters of application has been due to a considerable extent to that very propaganda. So, until you have your employers, employment managers, and personnel managers standardized, it may be dangerous to give general advice to your graduates as to just exactly what they should do when seeking employment.

If I should give any general advise in regard to this matter, I should say: "Before you apply in person to any employer, find out as much as you can about him and conduct yourself according to what you know about him personally, not necessarily what you know about his company," because many of these men have prejudices, many are not reasonable, and I think very few will respond favorably to any one particular type of approach.

I am going to give you one little example: Not so long ago I went to a certain high executive in a very large concern. The concern is not an engineering concern, but this high executive was an engineer. He was not doing engineering at all; in fact his work was far removed from engineering. The young man in whom I was interested was not present. He was 1200 miles away and I wanted to discover whether or not it would be worth while for him to come on. The young man was tremendously interested in the particular kind of work that this concern was doing.

The executive proceeded to tell me what kind of an approach he liked in college men and he said almost exactly what Mr. Davis said. Then he told me how he got started in his own career; and it was just exactly 180 degrees away from the advice he asked me to pass on to the young man. He said in something of a satisfied manner, "How did I get started here? I came into this organization as an engineer. After the war I was walking the streets. I had nothing to do. The thing that I needed above all was a job and I did not care what the job was. They told me they had no job. 'Well,' I said, 'you need your floors scrubbed, don't you?'

'Yes,' they said. I said, 'I will do that,' and that is the way I got started in this career."

What kind of confusion is this? Suppose this situation were described to a college graduate. What would you expect him to do?

I simply close with this suggestion: until you standardize the human characteristics of your personnel managers it is somewhat dangerous to standardize the methods of approach.

H. L. Davis: Of course there are all kinds of employers. The successful commercial salesman and the successful job-hunter who is seeking to sell his services must know what they are offering for sale. Both must adapt themselves to each prospective customer. They cannot do this without preparation. I advocate that you help your students to prepare themselves for their employment interviews. When thus prepared they can adapt themselves to any conditions. When unprepared, they have "nothing to say."

THE NEW EMPHASIS IN TIME AND MOTION STUDY *

By RALPH M. BARNES

Professor of Industrial Engineering, College of Engineering, University of Iowa

One of the tasks of the engineering college is to give instruction in the organization and operation of manufacturing enterprises. Those engineering students who expect to enter industry must not only know the fundamentals of the basic sciences but must also be familiar with methods of production. One of the functions of the work in industrial engineering is to supply this latter need.

Time study for rate setting has been commonly used in industry for many years and instruction in the methods and technique has been offered by engineering colleges for over a quarter of a century. While it is essential that time study be used for setting piece rates, the more important purpose of time study is for determining the easiest and the best method of doing work. One approach to finding the most effective way of performing a given task is through motion study or micromotion study. It is this new and valuable use for time study that will be considered in this paper.

Because this subject of micromotion study has but recently become of general interest a brief explanation of it will be given.

The engineer has made a place for himself in this age largely because he has contributed to the general material welfare of society. He has done this mainly by applying his knowledge and ability in creating devices, methods and processes which save time, money, material, and human energy and add to man's comfort and safety. In accomplishing these ends the engineer acts in many different capacities. At this time we are concerned with the methods which the engineer may use to improve the effectiveness of those who work with their hands—in other words, methods which save the energies and reduce the fatigue of the industrial workers.

Greatest progress in this direction has been made in the factory and the office because here are found operations that are repeated many times and large groups of individuals spend their entire work day in machine manipulation.

It is as much the task of the engineer to build the machine to facilitate and accommodate the person who is to operate it as it is to

* Paper presented at the S. P. E. E. Annual Meeting, June, 1935.

build it to perform specific mechanical functions. This fitting of the machine to the worker with the resulting improved labor effectiveness is primarily the task of the engineer rather than that of the physiologist or the psychologist.

Micromotion study provides one approach for the systematic study of manual work and invariably results in finding a better method of performing the task. Micromotion study implies that a study be made of the individual's actions, noting his minutest movements, such as motions of the hands, arms, legs, and the other members of the body. It is also necessary to study the action of the muscles and the nerves and to understand the causes of muscular fatigue and mental strain as brought on by manual work. One of the most useful methods of studying the movements of the members of the body while working is by means of motion pictures. Along with a study of the motions it is desirable to measure the time required for each movement. This can be accomplished by placing a specially designed clock beside the operator while the motion pictures are being made. This gives a complete record of both time and motion on the film.

The human hand is capable of moving very rapidly. For example, a worker inspecting pearl buttons moves so rapidly that she may make a complete motion in less than one ten thousandths of a minute. The cashier counting coins moves faster than the human eye can follow, yet the motion picture camera can record all of these motions and time them to any degree of accuracy desired. The ordinary amateur motion picture camera using 16 mm. width film is commonly used for this work.

From the analysis of the movements of the various members of the human body performing many different kinds of work it has been found that all motions may be divided into eighteen different well defined classes.

It might be well to illustrate a few of these fundamental motions —motions which cannot be further subdivided—by referring to the simple operation of picking up a fountain pen, writing, and returning it to its holder.

The method is shown step by step in the first column of Table I while the fundamental motions (or therbligs) are given in the second column.

The eighteen fundamental motions, a few of which have just been described, form a basis for studying manual work of all kinds. Research by engineers, physiologists and psychologists over a period of years has taught us some things about work that are very valuable to the engineer—particularly to those who design, build and

TABLE I
FUNDAMENTAL MOTIONS USED IN WRITING

Steps Used in Writing	Name of Fundamental Motions	Time in Thousandths of a Minute
1. Reaches for pen	1. Transport empty	10
2. Grasps pen	2. Grasp	3
3. Carries pen to paper	3. Transport loaded	8
4. Positions pen for writing	4. Position	3
5. Writes	5. Use	44
6. Returns pen to holder	6. Transport loaded	9
7. Inserts pen in holder	7. Preposition (this element is *preposition* rather than *position* because the pen is in readiness for the next *grasp*)	6
8. Lets go of pen	8. Release	1
9. Moves hand to paper	9. Transport empty	9

are responsible for the operation of tools and mechanisms which require human effort for their manipulation.*

You will, no doubt, agree that it is desirable to make work as easy and as satisfying as possible but in a competitive society such as ours in this country, only those things which are economical in the long run will be adopted by industry. The point has been emphasized that the application of motion economy principles results in reduced fatigue and improved labor effectiveness but thus far nothing has been said about the dollar and cents savings to the employer using these methods. Micromotion study pays big dividends from all angles. For example, the data † in Table II show

TABLE II
SAVINGS RESULTING FROM THE USE OF MICROMOTION STUDY

	1930	1931
Total number of jobs improved	58	39
Total savings, dollars	37,178	51,368
Total tool and equipment cost, dollars	3,197	2,651
Annual net savings, dollars	33,981	48,717
Average time saved, per cent	45.2	38.1
Tool and equipment cost in terms of total savings, per cent	8.8	5.1

that an Electrical Manufacturing Company in their Mid-western plant alone saved over 50,000 dollars in one year through the use of micromotion study, and the total outlay for tools and fixtures was less than 2700 dollars.

Mr. L. P. Persing, in charge of this work at the Fort Wayne

* For an explanation of the principles of motion economy see "Motion Study" by Ralph M. Barnes.

† *Mech. Eng.*, Vol. 55, No. 12, p. 731, December, 1933.

plant of the General Electric Company, states that on all of the work on which they had applied the micromotion method they had made an *average* saving in time of over forty per cent. He also emphasizes the point that the workers are enthusiastic about the new method since, in every case, it means that they will do the work in the very easiest way. He states that even though the employees using the improved methods actually produce more pieces per day they are less fatigued than formerly.

This depression has greatly accelerated the adoption of micromotion study for improving labor effectiveness because manufacturers, hard pressed to reduce costs and not being in a position to purchase new or special equipment, found that this new technique with little or no outlay for equipment, would often bring about substantial reductions in labor costs.

To summarize, the major function of time and motion study today is for improving methods of doing work rather than for rate setting. In designing and building a machine to perform certain mechanical functions the engineer should not overlook the fact that *some one* will use it. In making the machine to fit the operator the engineer will make life easier for the industrial worker and at the same time further his own ends by bringing about lower production costs to the manufacturer.

Teaching Time and Motion Study

The work in time and motion study at the University of Iowa is presented in two courses both of which are elective. In the first course two semester hours are devoted to stop watch time study, motion study and micromotion study work. This course is given during the first semester. It is followed by a second two semester hour course in which further practice is given in the micromotion study technique accompanied by investigations and studies of hand motions, skill, fatigue, "energy cost" of doing work, physiology of the human body as it pertains to muscular work and other essential factors. This second course is intended only for graduate students and those seniors primarily interested in this field.

Equipment and Facilities Available

A special laboratory (see Figs. 1 and 2) has been developed during the past five years and is set aside for time and motion study work. This laboratory is available both for research projects and for undergraduate instruction. We are equipped to present and demonstrate the fundamentals underlying time and motion study methods as practiced in the most successful plants in this country.

FIG. 1. Students at work in Time and Motion Study Laboratory, College of Engineering, University of Iowa, Iowa City.

Left rear: Projection booth for analyzing film.
Right rear: Students making motion pictures of a typical assembly operation.
Left foreground: Synchronous motor driven motion picture camera mounted above set up for photographing hand motions.
Right foreground: Research apparatus for analyzing hand movements.

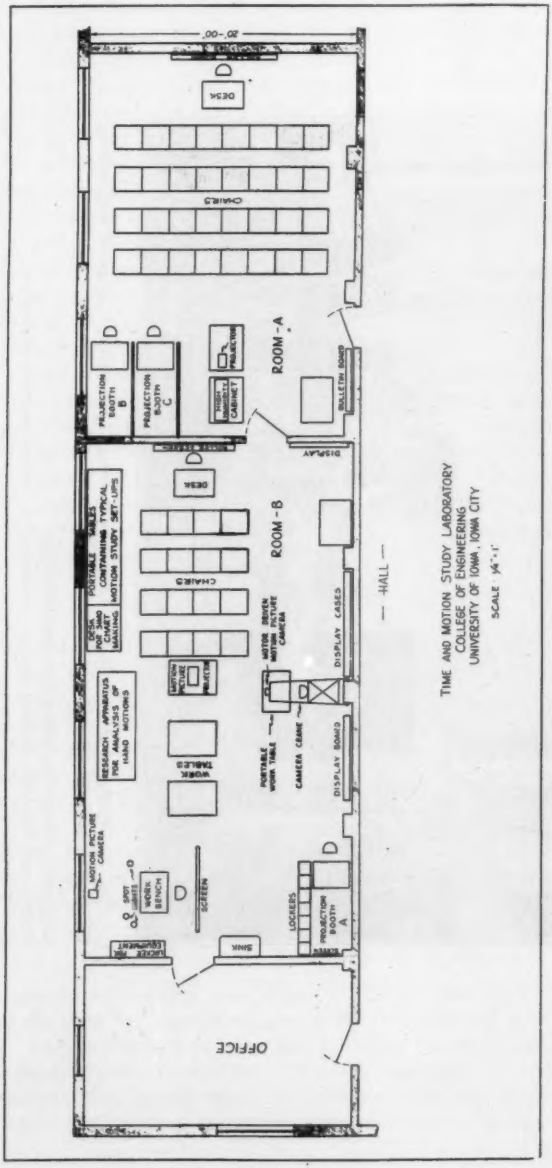

Fig. 2. Floor plan of time and motion study laboratory.

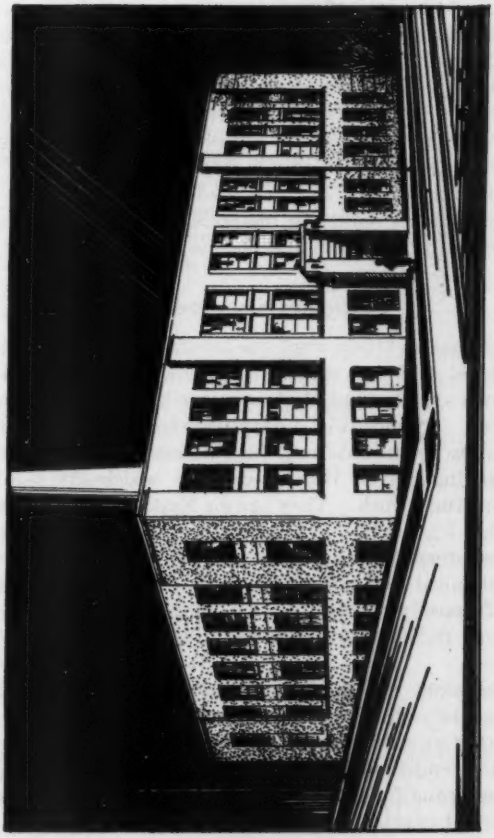

FIG. 3. Mechanical engineering laboratory.

Stop Watch Time Study

Decimal minute stop watches and time study boards of the conventional type are supplied to each student for his individual uses during the course. Special slide rules, speed counters, tachometers, speed and feed charts and data on cutting metals are available. Our new Mechanical Engineering laboratory shown in Fig. 3 contains the Manufacturers Laboratories which are available for demonstration and for student use. Thus the machine shop, forge and heat treating laboratory, foundry and wood products laboratory supply the students with plenty of actual subject material. The Manufacturers Laboratories, in addition to being equipped with the usual standard machines, are now tooled to manufacture several products by "mass production methods." Nearby industries also coöperate by supplying actual problems.

Micromotion Study

For micromotion study work the laboratory is equipped with an Eastman Model A 16 mm. camera which may be either hand cranked or driven by a synchronous electric motor to give a constant rate of film exposure. By means of a gear transmission, speeds of 1000 to 4000 exposures per minute may be obtained. The University also owns two spring driven 16 mm. cameras which are available for micromotion study work. They are an Eastman Special and a Bell and Howell.

Our laboratory has an Eastman Model B Kodascope equipped with a mechanical tachometer for indicating projection speeds directly in frames per minute. Five small projectors (Eastman Model C and DeVry) with 100 watt bulbs are available for film analysis.

The laboratory has three small stalls or booths in which film analysis may be carried on without darkening the room. The entire laboratory or either of the two rooms (see Fig. 2) can be darkened when extended film analysis is being carried on.

A special crane for mounting the motion picture camera is available for special problems and research work.

A museum of wrenches, screwdrivers, jigs, fixtures and specimen set ups is maintained for demonstration purposes.

Special equipment is available for experiments on accelerations and time of hand motions. Time measurements can be made with an accuracy of 1/1000 of a second.

Course Content

Since the first course in time and motion study will no doubt interest the greatest number its content will be given in detail.

A text book and lithoprinted manual * by the author are used in the course. This material is supplemented by lectures and by outside readings from books and magazines listed in a special bibliography prepared for the course.

Since the students registered in this course have already taken a three semester hour course in "Factory Management" they are familiar with the general aspects of time and motion study, wage incentives, and related subjects.

Not more than fourteen students are permitted to register in one laboratory section. Two students ordinarily work together on long projects. The class meets for two, one hour periods and one, three hour period per week.

Stop Watch Time Study

1. Review of objects and purposes of time and motion study.
2. Historical background and early use of time and motion study.
3. Steps in making a stop watch time study.
4. Methods of taking times.
5. Determination of allowances.
6. Methods of "rating" and "leveling."
7. Study of "skill" and "effort."
8. Determination of standard data for elements of operations.
9. Development of data for building up synthetic time standards.
10. Formula construction.
11. Critical evaluation of each of the factors entering into the determination of a time standard.
12. Metal cutting.
13. Labor's objections to stop watch time study—possible evils.

While the above material is being considered in the classroom, ten stop watch time studies are made in the laboratory and shops by each student.

Motion pictures, demonstrations and lectures supplement the student's text and outside reading assignments of the topics listed above.

Motion Study and Micromotion Study

1. Review of objects and purposes of motion study.
2. Historical background and early use of motion study.

* "Industrial Engineering and Management," McGraw-Hill Book Co., Inc., N. Y. "Motion Study," Edwards Brothers, Inc., Ann Arbor, Mich.

3. Physiology of the human body as it affects muscular work.
4. Contributions of psychology to "the way to work."
5. Study of apparatus for making micromotion studies and movement analysis.
6. Process charts—over all investigations for improving operating economy.
7. Definition of the eighteen therbligs with demonstrations of each.
8. Study of each of the twenty-four principles of motion economy as explained in the "Motion Study" manual.
9. Economical use of micromotion study.
10. The engineer, overproduction, and unemployment.

While the above material is being considered in the classroom each student (or pair of students) works out an improved method for some simple operation which will require the application of the principles of motion economy. Motion pictures are made of "old" and "new" methods and each student analyzes the film and makes a chart of each. Because of the lack of time in this course all of the students ordinarily do not actually build the jigs and fixtures needed in working out their particular problems but submit their solutions in report form for class discussion. There are sufficient standard bins, vises, jigs, etc. available in the laboratory to permit some students to set up apparatus to demonstrate their proposed method. These are then used as subjects for making motion pictures for analysis purposes.

SUMMARY OF CONFERENCES HELD AT THE 43RD ANNUAL MEETING

There were 114 papers presented at fifteen different conferences. It is impossible to publish all of these. Each Chairman was asked to write a report of his conference. We are giving you herewith those reports received in the Secretary's office by October 19, 1935.

F. L. BISHOP,
Secretary.

CHEMICAL ENGINEERING

Three sessions of the second conference on chemical engineering teaching were held at Atlanta. Those on Monday and Tuesday mornings, sponsored by the Committee on Chemical Engineering Laboratory, were devoted to laboratory instruction, particularly questions concerning a laboratory manual. That on Tuesday evening, sponsored by the general Chemical Engineering Education Committee, was concerned with more general papers on methods of instruction for the chemical engineering Unit Operations and Unit Processes and Undergraduate Research. In the unavoidable absence of Professor F. C. Vilbrandt (Iowa State College), Conference Chairman, Professors S. C. Ogburn, Jr. (Bucknell University), Chairman of the Laboratory Committee, and J. C. Elgin, (Princeton), Conference Secretary, presided over the several sessions. A total attendance of forty-one representing twenty-seven different institutions, at the several sessions was considerably greater than for the preceding conference and indicates the increasing interest in this activity of the Society. Besides the regular sessions, informal luncheon gatherings of the group were held, and also a joint dinner meeting of the two chemical engineering committees. Mimeographed copies of a number of the papers presented are available from the authors.

Professor Ogburn opened the Monday morning conference with a brief resumé of the preceding conference, the work of the two S. P. E. E. Chemical Engineering Committees, and the objects and program of the present conference. He then presented "A Study of Chemical Engineering Laboratory Instruction in the United States." This paper was based on the preceding year's investigation of the Laboratory Committee and the data supplied by 52 in-

stitutions in reply to a questionnaire sent to the approximately 93 institutions awarding a chemical engineering degree, 86 of whom replied. It supplied interesting and complete information on laboratory courses in the unit operations and other chemical engineering, their method of organization and administration, methods of laboratory instruction employed, unit operations and other chemical engineering experiments included in laboratory instruction and the equipment used, experimental directions and reports, and recommendations as to the unit operations which should be studied and the desirability of a laboratory manual. Mimeographed summaries of the replies to the detailed questions on the questionnaire were supplied to supplement the paper. In view of the value of the report, the conference expressed the hope that it might be published in full in the Society's JOURNAL.

Prepared discussions of the above paper were next presented by the members of the Laboratory Committee attending. Dean Cobleigh (Montana State) and Professor James (Carnegie Tech) summarized the development of the present accepted methods of laboratory instruction indicated by the report and outlined their ideas concerning proper chemical engineering laboratory instruction. Professors McCormack (Armour) and Elgin stressed the need for care in drawing conclusions as to the apparent agreement in laboratory methods indicated by the report and in the interpretation of the replies and data supplied. They also urged caution in interpreting the report as an indication of the *actual* status of chemical engineering laboratory instruction in the various schools, and emphasized the need for knowing *how* the operations were studied and *how* the equipment was used *as well as what* was employed. Professor Jenness (Maine) mentioned the viewpoint of the schools with laboratories in the development stage, and Professor Montillon (Minnesota) asked that the work of the Committee be continued to assemble and make available laboratory information obtained.

"A Study of Laboratory Directions for Unit Operations Experiments Used at Various Schools" by R. C. Kintner (Bucknell) was read by the Secretary. This paper summarized and correlated material of this type collected by the Laboratory Committee in the course of its study. The objectives of chemical engineering laboratory experiments indicated by the procedures submitted, the material embodied in direction sheets and their length, the experiments for which direction sheets have been compiled by various schools, and conclusions and recommendations for the content of such sheets were presented.

General discussion of the two papers and of laboratory in-

struction in which Professors Baker (Northeastern), Williamson (Tulane), James, McCormack, Boarts (Tennessee), Stewart (Newark), and Elgin participated followed. It was pointed out by McCormack and Elgin that the conception of the funds required for equipping a unit operations laboratory was in general too high. McCormack stated that an outlay of about $10,000 was entirely sufficient for a satisfactory undergraduate laboratory.

Following the convening of the Tuesday morning session by Professor Ogburn, a paper on "Designing Equipment for Unit Operations" was delivered by Professor McCormack. Specially designed equipment for the laboratory study of several of the unit operations was described and discussed. This was illustrated by slides of a horizontal and a vertical concentric tubular heat interchanger, fractionating column and still, filtration unit, special stainless steel kettle, and small jacketed kettles for nitration, sulphonation, and similar studies. The great advantages accruing from special design and construction of laboratory units was stressed. Questions by Professors Boarts, Randolph (N. C. State), and others regarding the equipment described were answered by the author who also expressed his willingness to supply design details for the various units to those wishing to communicate with him personally.

Professor Vibrandt's (Iowa State) paper on "Methods of Procuring Chemical Engineering Laboratory Equipment" was then read by Dean Cobleigh. Methods by which such equipment had been obtained at Iowa State College were outlined, and the equipment and laboratory facilities available mentioned. Methods included gifts from manufacturers of their equipment for experimental test, as left-overs from pilot plant development problems, from special industrial research funds and fellowships, and by purchase from a small budget for the purpose. In the ensuing discussion some of the methods mentioned were criticized by Professor McCormack, and their general applicability to many smaller institutions questioned by Professor Elgin. Professors James and Bray (Purdue) commented favorably on the methods described.

A paper on "Laboratory Methods and Equipment Used in Teaching Distillation" by Professors Withrow and Koffolt of Ohio State was given by the latter. It described in detail distillation equipment and the type of distillation experiments used at Ohio State. The wide variety of experiments made possible by the flexibility of the available equipment were discussed, and drawings and photographs of the equipment exhibited. In reply to questions, Professor Koffolt supplied further details concerning their laboratory course and the time devoted to it.

"The Value of Industrial Inspection Trips to Chemical Engineering Laboratory Work" was treated in an interesting paper by Professor Randolph (North Carolina State). By tracing briefly the development and present status of chemical engineering and chemical engineering instruction the speaker demonstrated the place of the inspection trip in the program. The objectives of such trips, methods of carrying them out, and their correlation with other courses were then indicated, and the types of plants, the studies suited to each, and the student reports required were described based on the practice of the Department of Chemical Engineering of the North Carolina State College. In the subsequent discussion Professors McCormack and Koffolt spoke in favor of industrial inspection trips for chemical engineering students and mentioned the practice in this regard at their respective institutions. In reply to a question by Professor Haas (University of Dayton), Professors Randolph and James stated that at N. C. State inspection trips were required but no academic credit given while at Carnegie Tech they were scheduled as a part of the regular chemical engineering laboratory course.

The remainder of the session was occupied by a symposium on the desirability of a chemical engineering unit operation laboratory manual to which prepared discussions were contributed by Professors Hodge (West Virginia), Weitz (Carnegie Tech), McCormack, and Montillon. After pointing out the stages in the development of scientific material and texts and the present status of chemical engineering in this respect, Professor Hodge expressed the opinion that while a satisfactory number of lecture and reference texts were available in this field, a chemical engineering laboratory manual was now needed. Professor Weitz's paper was read by his colleague, Professor James. Following a statement that a manual was desirable, Professor Weitz's ideas on the character, content, and organization of a manual were presented, the inclusion of sections on instrumentation and technique, procurement of data, report writing, and possibly the unit processes as well as procedures for unit operation experiments being advocated. After discussing the desirable objectives of chemical engineering laboratory instruction, Professor McCormack pointed out the necessity for laboratory directions of some description and the advantages which might be expected to accrue were such a manual available. He mentioned the manual prepared and utilized by himself at the Armour Institute. Professor Montillon showed how the objections raised in the past to a laboratory manual for the unit operations might be avoided by proper type of directions, flexibility, and the inclusion of optional experiments, and stated

that steps toward the collection of procedures for a manual should now be undertaken. The speakers concurred in the opinion that a manual was to be desired.

Subsequent to round table discussion of the above subject by the conference, it was unanimously agreed that a chemical engineering laboratory manual was desirable; that definite steps toward the securing of laboratory procedures for such a manual should be immediately undertaken; and, that all present would undertake to utilize and subject to trial a manual when prepared. Decision on the actual method of preparing the manual was reserved for a subsequent conference, but the following initial procedure as suggested by Professor Ogburn and the joint Chemical Engineering Committees was endorsed. Individuals selected by the Chairman of the Laboratory Committee are to be requested to undertake the preparation or selection of general laboratory procedures for each of a number of unit operations selected from those generally agreed on in the Committee's report. These may be selected from the laboratory directions from various institutions already or subsequently to be obtained, or acceptable procedures may be devised based on them. These will then be presented for critical review and acceptance at the next conference.

The Tuesday evening session was opened by the Conference Secretary who presided. Through a misunderstanding concerning the topic on which he was invited to speak, Professor James' paper was on "Chemical Engineering Unit Operations in Lecture Instruction" rather than the Unit Processes as scheduled on the program. It dealt with the material content and unit operations which should be included in unit operations lecture courses, their place and relationship to other courses in the curriculum, and methods of classroom presentation. Discussion by Professors Haas, Koffolt, Williamson, Stewart and James, dealing with the place of physical chemistry in the curriculum, type of unit operations examinations, importance of humidification as well as the drying operation, methods of conducting chemical engineering courses, and chemical engineering problems, followed.

Professor Koffolt next presented a brief paper on methods of conducting laboratory courses in the unit operations. This was followed by Professor Ogburn on "Laboratory Instruction in the Unit Processes." He outlined the type of experimental work, methods, and equipment employed for this purpose at Bucknell and described the nature of the reports required. The experiments described dealt with a complete chemical manufacturing process involving a combination of the unit operations, cost studies, and preliminary plant designs. It was pointed out in the discussion

of the paper that a great deal of confusion existed regarding the meaning and application of the term, "Unit Processes," that Professor Ogburn's paper dealt previously with the study of unit Professor Ogburn's paper dealt previously with the study of unit processes occurring in a complete chemical process, and that the work described by him corresponded to courses titled process development and plant design at some institutions.

Professor McKee (Columbia) was unable to be present to present his paper on "Instruction in Non-Mathematical Phases of Chemical Engineering" as scheduled on the program.

The final paper of the program, "The Place of Undergraduate Research in Chemical Engineering Instruction" by Professor Vilbrandt, was read by Professor Weber (Georgia Tech). It pointed out the value, place in the curriculum, methods of conducting, equipment required, and types of problems suitable for undergraduate research in chemical engineering and outlined the plan of attack employed at Iowa State College and the method of investigating the chemical literature. The importance of proper guidance of the student by the faculty member in charge of his research was emphasized. General discussion of the value and the requirement of undergraduate research or theses in chemical engineering followed. In reply to Professor Ogburn's request six of the institutions represented indicated that they required thesis or project work for the B.S. degree in chemical engineering. Sentiment in favor of undergraduate research was expressed by Professors Ogburn, Koffolt, Boarts and Elgin, while Professors Hodge, Williamson, and Horton were opposed on the grounds that in view of the scarcity of time, this were better devoted to other subjects.

Discussion of the continuance, constitution, subsequent work and procedure of the Laboratory and Chemical Engineering Education Committees postponed from the morning session was continued. It was moved by Professor Randolph and unanimously carried "that the Chemical Engineering Laboratory and the Education Committees both be continued, and that the former be instructed to continue its work on the development of a chemical engineering laboratory manual." A motion by Professor James "that Professor Ogburn continue as Chairman of the Laboratory Committee, that he reconstitute the personnel of this committee in accordance with the work to be done as he sees fit, and that the method of procedure toward the preparation of a laboratory manual be left at the discretion of the Committee" was carried. It was moved by Professor Baker and carried "that the Chemical Engineering Education Committee be requested to make a study of

the distribution and time allotted to chemical engineering subjects in the curriculum of the various schools in the country."

It was suggested that the following subjects be made subjects for papers and considered at the next conference: Symposium on Laboratory Procedures for Selected Unit Operations; Methods of Teaching and Presenting in Lecture Selected Groups of the Unit Operations; Use and Functioning of Chemical Engineering Problems; Nomenclature in Chemical Engineering; Use and Functioning of the Chemical Engineering Library.

A resolution expressing the appreciation of the group to the Society, the Chairmen and the Secretary of the Committees, the Georgia Institute of Technology, and its Chemistry Faculty for their efforts and coöperation in making a highly successful conference possible was unanimously voted. Upon vote and contributions from the group a telegram of condolence on the recent death of his brother and regret at his inability to be present was dispatched to Professor Vilbrandt, Conference Chairman, by the Secretary.

J. C. ELGIN,
Secretary.

CIVIL ENGINEERING

The first annual conference of the newly formed Civil Engineering Division was devoted to a consideration of the "Changing Phases of Civil Engineering and Their Relation to Education"; this theme carried out President C. C. Williams' general topic, "Looking Ahead," for the Atlanta Convention of the Society.

Both general and group meetings were provided. At the general sessions the broader and more common problems of civil engineering education were discussed, including

1. The Objectives and Methods of Training in Civil Engineering.—H. S. Rogers
2. The Civil Engineer in the Construction Industry.—Willard Chevalier
3. Engineers and the Problems of Highway Management and Operation.—Roy W. Crum

The purpose of the group meetings was to discuss, comprehensively, the newer and changing phases of specific branches of civil engineering with particular emphasis upon the educational problems involved. To develop this plan, it was essential to build the program around the threefold qualifications of the engineering teacher: first, a thorough acquaintance with basic and current engineering practice; second, either active participation in the ex-

tension and verification of engineering principles and factual data, or a broad but accurate knowledge of the findings of tests, investigations, surveys, and researches in his special lines of interest; and third, the desire and ability to establish major objectives and methods of engineering training in accordance with sound educational principles.

The Transportation-Surveying group devoted itself to an intensive study of the most effective manner in which the principles of Traffic Control and Safety may be introduced in the highway courses. The Hydraulic group discussed the Basic Principles in River Hydraulics and the Teaching of Elementary Hydraulic Laboratory Work. The Structural group considered the general topic of Foundations and Soil Mechanics; three papers presented the historic and research developments; one paper dealt with a practical soils mechanics laboratory; and three papers described courses planned for laboratory work, for undergraduate, and for graduate students.

Altogether there were twenty-four papers given at the civil engineering conference; of these, six were presented at the general meetings, seven on Foundations and Soil Mechanics, five on Basic Principles of River Hydraulics, four on Traffic Engineering, and two on Construction Education.

Through the coöperation of the Georgia Section of the American Society of Civil Engineers, Professor R. P. Black, President, the Division members were privileged to relax at the end of the first day on the broad lawns of the Druid Hills Golf Club. A barbecue dinner was served with all the generosity of our southern friends and to the accompaniment of a shady complexioned pianist. The American Society of Civil Engineers honored our conference by sending greetings through Mr. Frederick H. McDonald, Director, and Mr. A. P. Richmond, Assistant to the Secretary.

A complete copy of the program may be found on pages 36 to 39 of the September 1935 issue of the JOURNAL OF ENGINEERING EDUCATION. In order that the conference programs might be coordinated with the convention program the Civil Engineering Division held two morning and two evening sessions on Monday and Tuesday, June 24 and 25. The local committee on arrangements, consisting of Professors Snow, Black, and Lucas of the Civil Engineering department at Georgia School of Technology, made the work of the officers of the Division easy and the attending members comfortable.

The retiring members from the Executive Council are Professor Gordon M. Fair, Harvard University, and Dean T. R. Agg, Iowa State College. The chairman wishes to acknowledge the esteem

in which he holds the counsel he received from these men as well as from the remaining members. During this first year an extensive survey was made of all civil engineers engaged in engineering education. An abstracted report will appear in an early number of this JOURNAL.

It is fitting to close this first annual report with sincere tribute to Professor L. E. Conrad, Kansas State College, for the vision, courage and determination he exercised in proposing and establishing the Civil Engineering Division. The chairman, with the able and generous counsel of the Executive Council members and with the prompt, effective, and friendly support of President Williams and Secretary Bishop, has tried to establish broad policies that may be attuned to future needs, and to organize a group of committees that will form the active agencies through which the Civil Engineering Division will continue in its present vigor.

FRANK KEREKES,
Chairman, 1934–35.

COÖPERATIVE ENGINEERING COURSES

The meeting was called to order on Tuesday, June 25, 1935, at 11:30 A.M. in 109 Chemistry Building. Chairman R. C. Disque of Drexel Institute presided.

Chairman G. T. Addison reported for the committee appointed to consider the resolutions offered by the University of Cincinnati relative to the placing of coöperative students in jobs requiring Civil Service examinations. It was moved, seconded and passed that the resolution be adopted. A copy of the resolution is in the hands of the Chairman.

It was moved, seconded and passed that Chairman Disque appoint a committee to deliver a copy of the resolutions to President Franklin D. Roosevelt.

Chairman of the nominating committee, C. A. Kapp of Drexel, reported. The committee recommended that Dean F. A. Kartak of Marquette University be nominated for Chairman for the coming year. Upon motion Dean Kartak was declared elected.

Dean C. J. Freund of University of Detroit moved that a vote of thanks to Dean Disque for his work during the year be recorded in the minutes. Seconded and passed.

Chairman Disque thanked the delegates for their coöperation and expressed gratification for the success of the meeting.

The meeting adjourned at 12:00 P.M.

Respectfully submitted,
W. J. STEVENS, Drexel,
Secretary, pro tem.

THE PLACE OF SHOP WORK IN THE CURRICULUM OF A COÖPERATIVE ENGINEERING COURSE

By William J. Stevens, Drexel Institute

In the opinion of the Drexel Institute faculty wood shop, forge shop and foundry work can be dispensed with, but a moderate amount of machine shop should be retained. Wood shop is not essential because its operations resemble those of the machine shop. Hand forging has given way to machine forging and foundry work requires more equipment than is justified by the extent of its application in industry. Machine shop should be retained in order that the student may appreciate the limitations and applications of tools and machines which are very widely used in industry and in order that he may become acquainted with the properties of the various metals.

The college course should be designed to explain fundamental operations and to combine these with a study of elements of design, mechanics, kinematics and strength of materials. The college shop work should not duplicate high school shop work, and it should not be planned to make a student a skilled mechanic. It should teach him the reasons for the various operations. The coöperative work does not fully meet this requirement. Not all students are placed in the shops and those who are need a little preliminary instruction which cannot effectively be done in an industrial plant. In fact, many factory foremen dislike to accept an entirely green hand especially on piece work jobs. When a student goes into an industrial shop with a knowledge of the fundamental operations, he is likely to make a very much better impression than he otherwise would. The content of the college shop can be arranged in such a way as to supplement very effectively the student's work in his other courses. Drexel Institute does not include high school shop work in its entrance requirements. In fact, students intending to enter the Institute are encouraged to take the academic course in high school, because the best engineering students have been found to be those who have done so.

COÖPERATIVE PROBLEMS PRESENTED BY THE NEW POLITICAL AND ECONOMIC CONDITIONS

By G. T. Addison, University of Cincinnati

Mr. Addison's paper pertained principally with relations with government departments including the Engineers, Bureau of Standards, the Coast and Geodetic Survey and the Geological Survey. The N. R. A. increased opportunities for coöperative students on account of the reduction of hours in the industries.

Rates of pay were also increased under the codes. One problem in Cincinnati was raised by apprenticeship courses by which the students would enter into a contract with industries and the State Labor Department. The apprenticeship arrangement is agreeable in all respects except that which requires a contract.

The public works program has been of considerable help especially after the residence requirements were eliminated. The emergency conservation work has yielded some positions for civil engineering students, who lived in the C. C. C. camps. The T. V. A. has not brought as many opportunities as it should have done on account of the classification of coöperative students as non-technical workers. This classification has been changed so that coöperative students may now be used as technical workers and, therefore, need not reside in the T. V. A. district.

The question of labor and trade organizations has not been acute in the Cincinnati area. The Union rules have forced most of the companies to be very careful in considering applicants for work, especially by classifying workers in such a way as to discriminate in favor of married men as opposed to single men and as in favor of indispensable employees as opposed to the casual group. The plants have been favorable to coöperative students, usually dismissing them last when the forces are reduced.

The Civil Service program is one of vital interest. The relations with the Civil Service Department of the City of Cincinnati have been satisfactory. The students on the whole have not been required to pass the civil service examinations as long as they were students, but on graduation they had to be dropped from the payrolls.

The great need at the present time is to secure the coöperation of the U. S. Civil Service Commission in order to open up co-operative positions for our students. It is essential in order to do this to obtain such an interpretation of the Civil Service Regulations as will enable properly qualified students to obtain employment from the federal service on the coöperative plan. To this end Mr. Addison offered a resolution which was passed by the Division to be laid before the President of the United States asking for such favorable interpretation of the law.

THE COÖPERATIVE SYSTEM AND RECENT ECONOMIC AND POLITICAL CHANGES

By F. A. Kartak, Marquette University

The coöperative program of Marquette University was instituted eight years after the passage of the Wisconsin Vocational

Education Law. Under this law the Milwaukee community program involving about fifty-six plants was started to train cooperatively sufficient number of young men each year to meet the community needs. By this program each industrial unit assumed its share of the training burden. Definite shop and pay schedules were included by formal contracts to which the employer, student and state were parties. The Coöperative Department of Marquette University was neatly fitted into this program. We had the advantage of a definite contract which prevented the employer from exploiting the young student and which gave him a continuous training. There was an enormous increase of cooperative engineering students between 1919 and 1929. The depression reduced this very sharply but the figure is now gradually rising. The Wisconsin program should be of interest to everyone because it is proposed to extend the system to other states. National legislation regulating employer-employee relationships is not likely to play a very important part in the training of engineering apprentices in Milwaukee, largely because the students are recognized as destined not for the trades but for engineering and management. The formal apprenticeship training seems to offer a favorable ground-work for coöperative employment and it is believed that its extension over the entire country would prove of great value and benefit to coöperative colleges.

THE EFFECT OF PRESENT ECONOMIC CONDITIONS ON THE PLACEMENT OF COÖPERATIVE STUDENTS

By H. N. Cummings, Newark College of Engineering

The new social and economic conditions are emphasizing the importance of human relations in our national life. This trend is certain to enhance the value of coöperative engineering training. It seems clear that engineers, skilful in solving human relation problems, will be in greater and greater demand. Students so trained will gain such an understanding of human nature that they will be able to get along with their superiors, their associates and those working under them. Both managers and workers are gradually coming to understand these things. Our task is to encourage industrial managers to understand better the value of coöperative training in developing the ability of engineering graduates to attack problems in human relations. So, a great opportunity to meet these growing problems lies with the coöperative institutions and it is hoped that those institutions will take full advantage of that opportunity.

REMARKS ON THE COÖPERATIVE ENGINEERING COURSE

By Charles S. Stone, Atlantic Steel Company

The Atlantic Steel Company has employed since 1911 an average of eight coöperative students a year, most of whom have been over the legal age of sixteen years. The original alternation was in periods of one week; this was later changed to two weeks, then to one month, and finally to three months. Our program for cooperative students includes three years of work in the shops, the last two devoted to experimental testing and engineering. Our company manufactures basic open hearth steel with a capacity of about 125,000 tons of steel ingots, which are converted into bars, small shapes, hoops, bands and wire rods. The coöperative students, therefore, have many opportunities during their five years to observe and assist in many chemical and electrical processes used in producing steel. Our company believes that the cooperative plan is valuable to the men themselves, to the institution they attend and to the community, but the plan also has great advantages to the company. First, the coöperative students are higher in intelligence than ordinary mechanics, they apply themselves more zealously to the technical phases of their work, and furthermore after graduation they go into fields of work in which their knowledge of our company, its products and policies ought to react favorably upon the company's business. In the next place the coöperative student can, and often does, serve as an inspiration to his fellow workers by his enthusiasm and interest. There are some disadvantages to the company; the principal ones are failure to complete the course, lack of ability or interest on the part of the student and the interruptions in the employment. In spite of these, however, we are satisfied that the student who makes the most of his opportunities in the coöperative course will be an asset to us, or to some other industry, and to the community. He has a background of five years of coöperative experience that would otherwise be acquired only at the expense of his employer.

THE COÖPERATIVE STUDENT IN TEXTILE ENGINEERING

By C. A. Jones, Georgia School of Technology

The coöperative course in textile engineering at Georgia School of Technology is the only course of this type in the country. The enrolment in the textile coöperative course at Tech is small on account of rigid entrance requirements, difficulties of the course and the problem of maintaining continuous employment in the textile plants. The third cause has lately been to some extent removed because the general employment situation has improved and the

wage scale has been raised. Also, the interest of the textile plants in coöperative students has become greater and more plants are, therefore, taking coöperative students. At the present time there are about thirty plants in Georgia and the surrounding states which are using coöperative textile students. The advantages of a coöperative course over a regular course include the ability to earn part of college expenses, experience in technical processes, and experience in dealing with fellow employees. The importance of the last of these is becoming greater and greater as indicated by the increased interest taken by textile manufacturers in the problems of human relations, which have been of most critical importance in the textile industry. This is indicated by statements of superintendents of textile mills who have employed coöperative students. In all cases these officials are enthusiastic about the advantages of the coöperative plan, both to the mills and to the students. The greatest difficulty lies in keeping students employed in depressed times. To be successful the coöperative education programs require sympathetic and continuous support on the part of the industry and tactful administration on the part of the college. Given this, much may be expected from the coöperative plan in textile engineering.

THE ADVANTAGE OF PERMANENT EMPLOYMENT IN INDUSTRIAL SHOPS

By C. J. Freund, University of Detroit

There has been a reluctance on the part of engineering graduates to build their careers in the shop. Most of them remain there only as long as they have to, hoping later to go into the drafting room, the laboratory or the sales office. Engineering graduates would be well advised to change their point of view and plan to devote their lives to production in the shops; they will find more opportunities there for beginners and very attractive possibilities for the future. Strictly technical opportunities are limited and it is most certain that the future will open up significantly large numbers of opportunities such as have existed in the past. Nothing seems to be in sight capable of causing the tremendous expansion which came first with the railroad, then with the telephone and the automobile. Therefore engineers, like the older pioneers, should seek new territories; they will find them in the shop. The most important problems lie in the manufacturing field. There is the problem of relieving the strain of human relations in industry. It is recognized that in the future, for the benefit of the whole community, the larger share of returns from industry must come to the consumers and a small share to the savers and investors, as was stated

by Mr. Ralph Flanders in the Atlantic Monthly for November 1933. Then, there is the question of preparation for higher administrative posts. Engineers, who take their apprenticeship in the shops, ought to be better prepared for these positions than any others. About sixty per cent of all engineering graduates eventually become administrators, but this is not enough. Engineers should develop those abilities which would enable them to fill more administrative posts of responsibility. Too often engineers have been narrow in their outlook on life and it is believed that experience in the shop should broaden them. There are opportunities in the shops too, because the competition there is less than it is elsewhere. A very small percentage of engineering graduates are in production and a very small percentage are found in the shops in all positions. Most works managers, production managers, superintendents and other executives are non-technical men. This can be changed, if the engineer will get his experience in the shop. Here is an opportunity for the methods of scientific management, which still has many possibilities. In fact, reports indicate that the median earnings of industrial engineers have been about one thousand dollars greater than those of others in the profession. Coöperative colleges should take these trends into account. In fact, their programs lend themselves particularly well to coöperative training because that type of training offers particular advantages in developing administrative and operating ability. The coöperative student should not only learn the technique of the manufacturing processes; he should learn to be democratic, to make quick decisions, and to observe engineering problems in the rough. This and many other qualificatiions, not usually considered essential in the engineering equipment, are very important in the shop. These qualifications are best developed by the coöperative plan. Tradition is the only stumbling block; everybody expects the chief draftsmen to be an engineer, but nobody expects the superintendent to be one. We must develop the professional spirit in the shop and, when we do, the engineer will find his greatest opportunities there.

THE EFFECT OF UNIONS UPON THE PLACEMENT OF COÖPERATIVE STUDENTS

By C. A. Kapp, Drexel Institute

Before the depression practically all our coöperating plants were operated open shop so there was, in general, no difficulty in the placement of students. In the few closed shops with which we operated, adjustments with the union were made by which coöperative students were classified as students and not as apprentices. The students did a great variety of work and were not allowed to do

work ordinarily done by regular journeymen. They joined the union and paid dues, but not the initiation fee. In electrical construction work, which was on the closed shop basis, our students were classified as apprentices; they joined the union and had no difficulty.

After the N. R. A. was put into effect many strikes were called and we had to decide on our policy in regard to strikes. In case of strikes, our policy is to be entirely neutral and to allow the students to use their own judgment in attending union meetings but not to do picketing. If forty per cent of the employees leave a plant during a strike, our students are required to report to us immediately and in the meantime to remain away from the plant. We do not allow our students to be used for strike breaking purposes.

Coöperative students can learn a good deal of labor problems in strikes. In general, our policy is to deal with the company rather than with the union, where the closed shop prevails. After a strike in one of our coöperative plants, the employees succeeded in gaining a closed shop. This meant that our students had to join the union, paying an initiation fee of five dollars and monthly dues of one dollar. When the student returns to college, he is given an honorable withdrawal card; no dues are required of him while he is in college, and upon his new employment he resumes his status as a union member without initiation fee. The union has no ill feeling against students and I have never heard of any discrimination against them. It is sometimes hard to place workers in this plant because all experienced union workers must be employed before we can send inexperienced non-union workers to the plant.

In another plant after a strike, a closed shop was gained by the union but the union was not approved by the A. F. of L. A second strike to gain complete control of hiring and discharging employees was lost by the union and this plant is now operated on the open shop; the men are contented and many of our students are employed. In a shipbuilding plant, the company was unionized after the adoption of the N. R. A. During the strike, our students were withdrawn but subsequently we were able to place our students as students but not as helpers or apprentices. In the oil refinery business, most of the companies have become unionized. Some have unions affiliated with the A. F. of L. They have been practically free from strikes. There was one exception. One refinery had a strike. After one week seventy per cent of all the employees agreed to go back to work and to allow our students to return, if they desired. In another refinery, there are two unions, one a

company union and another an A. F. of L. union. We allowed our students in this plant to make their own choice of joining either union or remaining out of both of them. So far, all of our men have preferred not to join any union, but this has kept them out of certain departments. As in the case of all unionized plants, it is not easy for us to get new men into the plants so long as union men are out of work. In a large radio manufacturing company, there are two unions. Students are not required to join, but some actually do. We have not had any difficulty in this plant.

The N. R. A. and the Wagner Bill have encouraged the formation of unions and this may mean somewhat more difficulty for us in placing students. This will probably mean that we shall need more coöperation from the unions than we have had before. The A. F. of L. is in favor of the coöperative plan of education, and we have been informed that, so long as the A. F. of L. is in control, we shall be able to have satisfactory relations with the union.

ELECTRICAL ENGINEERING

The first session of the Electrical Engineering Conference was called to order at 9:30 A.M., Monday, June 24. There was an attendance of 55.

It was voted to adjourn at 11 A.M. to permit interested members to attend other Conferences, and to hold a second session on Tuesday morning.

The first subject on the program dealing with placement probabilities, needs of industry for trained men, etc., as outlined in the Convention program was discussed at length by

M. M. Boring, General Electric Company
O. W. Eshbach, American Tel. and Tel. Co.
E. B. Roberts, Westinghouse Elec. and Mfg. Co.

Discussion from the floor at this session was confined to remarks by Charles F. Scott, after which adjournment was taken.

A dinner of the electricals was held at 6 P.M. at the Winecoff Hotel in Atlanta at which 50 were present. A pleasant occasion was concluded by an interesting address dealing with the Water Power of Georgia by Mr. William Hammond, Chief Engineer of the Georgia Power Company.

The second session of the Electrical Engineering Conference was called to order at 10:45 A.M., Tuesday, June 25.

In the absence of the authors, prepared discussions dealing with the second subject on the Convention program, Philosophy of A. C. Machinery Textbook Treatment, were presented by the Chairman.

The prepared discussions were sent by Prof. H. W. Bibber, Ohio State University, and Dean A. S. Langsdorf, Washington University, St. Louis.

Several brief discussions were then contributed from the floor.

The third and last formal subject dealing with methods of presenting ionic fundamentals was opened to discussions from the floor and revealed the manner of handling the situation at a few institutions. The solution of the time difficulty seemingly is being met by cutting down on shop and drawing courses more often than otherwise.

At the conclusion of the session it was voted to request Council for authorization of the formation of an Electrical Engineering Division of S. P. E. E.

Permission having been granted by Council for the formation of the requested Division, a specially called meeting of interested electricals was held at 9 A.M., Wednesday, June 26.

A temporary Secretary was appointed for this meeting, Prof. E. W. Winkler, University of North Carolina, and W. S. Rodman, Chairman of the Electrical Engineering Committee, presided.

A skeleton organization was effected by the election of Division Officers as follows:

Chairman—W. S. Rodman, University of Virginia
Vice-Chairman—M. C. Hughes, Texas A. and M. College
Secretary—E. A. Bureau, University of Kentucky

It was voted that the personnel of a complete Executive Committee and Program Committee for the Division should be determined by the officers as soon as possible, with due regard to reasonable distribution of representation.

Several tentative subjects for possible consideration as major program features for the year were proposed and the final choice of subject matter was left for the Executive and Program Committees to work out.

The last session of the Conference then adjourned.

W. S. RODMAN,
Chairman.

ENGINEERING ECONOMY

A very successful conference on the Teaching of Engineering Economy was held on June 25, under the joint sponsorship of the mechanical engineering and industrial engineering committees. The attendance was about 80. The following papers were presented:

Treatment of the Cost Aspects of Engineering in School, by Professor Edmund D. Ayres, University of Wisconsin.

Engineering Economics, Why? Where? What?, by Professor George W. Barnwell, Stevens Institute of Technology.

A Course in Engineering Economics, by President Donald B. Prentice, Rose Polytechnic Institute.

Economics and Engineering Economy, by Professor Lawrence R. Guild, Carnegie Institute of Technology.

The papers were discussed by Professors J. R. Bangs, Jr. Cornell University; G. H. Shepard, Purdue University; C. E. Bullinger, Pennsylvania State College; E. E. King, University of Illinois; C. H. Casberg, University of Illinois; G. W. Barnwell, Stevens Institute of Technology; C. A. Koepke, University of Minnesota; P. A. Cushman, Valparaiso University; and Dean G. W. Case, University of New Hampshire.

Professor Ayres emphasized the fact that engineering practise is carried out in an atmosphere of cost considerations, and that no complete separation of cost aspects and technical aspects is possible. However, in engineering colleges the two aspects of the problem are kept separate and "efforts to unite them are blocked by at least two very important considerations: (1) the lack of teachers imbued with the relative significance of costs in engineering, and (2) the impossibility of generating in the classroom a 'pocket-book consciousness' from actual responsibility for financial consequences of engineering work." Professor Ayres believes that we should approach as closely as possible to the ideal situation where the economic aspects are included in the various technical courses, but that this goal is not within our reach at present, and that therefore it is necessary to offer separate courses in the cost aspects of engineering.

In this paper Professor Barnwell included under the heading "engineering economics" the courses in economic theory, applied economics and management which are offered in the Department of Economics of Engineering at Stevens Institute. Professor Barnwell pointed out that "the trend is definitely towards a greater amount of variety of material, in both the offered and required courses." In answering the question of why teach engineering economics, he called attention to the fact that eventually over seventy-five per cent of engineering graduates are working with the economic and administrative aspects rather than the technical aspects of engineering. He also discussed in some detail the problem of whether engineering economics should be taught in the several engineering departments or in a separate department. While admitting that a good case might be made in supporting the ar-

rangement first mentioned, he stated that provided the right sort of personnel is available, he is inclined to favor the teaching of engineering economics in a separate department whose staff should all be graduate engineers with a minimum of five years' industrial experience, and with special training in the fields of pure and applied economics.

President Prentice described a course which includes pure and applied economics and also certain of the administrative aspects of engineering. He called particular attention to the fact that it is not necessary to devote a large amount of time to such courses, and suggests that the material can be covered in a total allotment of six semester credit hours. He also stated that engineering students can progress much more rapidly in courses of this sort than can arts students, but that it is rather difficult to find a satisfactory textbook for use in teaching economics to engineering students. President Prentice also stated that in addition to the special courses, the economic aspects should be emphasized in the traditional engineering courses such as power, machine design, hydraulics and structures.

Professor Guild called particular attention to the differences between the training of the economist and the engineer, stating that economics is developed around the word "why," while engineering has been developed around the word "how." He also stated that sooner or later each gets into the territory of the other, and that the economist and the engineer need each other's coöperation. "If the economist can bring his subject down to a plane more immediately usable his work will have more appeal to the Engineer. If the Engineer realizes that he must seek beyond the mere answer to 'will it pay,' he will be ready to influence economics. If the Economist cannot, or will not, develop the practical side of his subject, let the Engineer do it for him. If the Engineer cannot, or will not, appreciate the value of the broader subject, there is no reason why the economist should not utilize engineering methods to improve his material and method."

In view of the great interest in this subject it seems desirable that a similar conference be held in connection with the 1936 meeting of the Society. An attempt should be made to interest additional groups in joining in the sponsorship of the conference. It would also be desirable to secure at least some papers from members of the Society who are teaching the economic aspects as part of the various technical courses.

PAUL T. NORTON, JR.,
Chairman.

INDUSTRIAL ENGINEERING

The conference was held on June 24 with an attendance of about 20. Papers were presented by Professor R. M. Barnes, University of Iowa and Professor G. H. Shepard, Purdue University. Following the presentation of the papers there was a lively and interesting discussion of the papers and of industrial engineering in general.

Professor Barnes discussed the teaching of time and motion study in engineering colleges, the title of his paper being, "The New Emphasis in Time and Motion Study." Professor Barnes pointed out that while time study is essential for setting piece rates the more important purpose is to determine the best method of performing a given operation. Therefore engineering colleges are justified in giving instruction in the principles which underlie modern time and motion study, with laboratory practise in the application of these principles. The paper described the courses offered at the University of Iowa, which are senior electives for mechanical engineering students.

Professor Shepard spoke on "Industry, Government and the Engineer." He furnished the Chairman with the following summary of his paper:

"We engineers have made our life so complicated and have made us all so dependent on one another, that our collective affairs can no longer be allowed to run wild but must be managed.

"We engineers have developed the science of management.

" It is up to us to tell the world how to apply it."

PAUL T. NORTON, JR.,
Chairman.

MACHINE DESIGN

The sessions of the Machine Design group were very well attended. At the session on June 24th, Professor A. W. Luce of Lehigh University presented an interesting paper on "Combining Courses in Kinematics and Machine Design." He reported particularly on the experiences of Lehigh University where this plan has been successfully adopted. In the absence of Mr. George F. Nordenholt, Editor of *Product Engineering,* Professor C. W. Ham of the University of Illinois read an abstract of Mr. Nordenholt's paper on "The Requisites of a Teacher of Machine Design." Both papers provoked considerable discussion.

On June 25th the Machine Design group met at a joint meeting with the Mechanical Engineering and the Manufacturing Processes

groups for a consideration of Shop Courses. This meeting, which was held in the evening, was attended by more than 100 people.

A meeting of the Executive Committee of the Machine Design Division was held on June 24th. Plans for activities of the Division, and also of the Machine Design Clearing House for the next year were discussed. The Clearing House now has eighty members who exchange problems and discuss phases of teaching Machine Design in a bulletin which is issued monthly during the college year.

V. M. FAIRES,
J. M. FOSTER,
C. W. HAM,
E. MACNAUGHTON,
F. L. EIDMANN, *Chairman.*

MANUFACTURING PROCESSES

In 1934, there was organized a division in the S. P. E. E. called, Laboratory Procedure in Teaching Machine Production. The purpose of this division was to study the engineering shop laboratories in relation to professional engineering and to attempt to bring this work up to the place it should occupy, and have it contribute its important part to the training of future engineers.

Due to a certain ambiguity in the original name, the division has been renamed and in the future will be the division on manufacturing processes.

The 1934 conferences centered around the objectives of the "Shop" or manufacturer's laboratories.

The 1935 program was centered in one conference, made into a joint meeting of all those vitally interested in this phase of engineering education. This session included the Industrial Engineering, Mechanical Engineering, and Machine Design Divisions, as well as the Manufacturing Process Division. There was an extremely large attendance at this meeting, and judging from comments made to the Secretary after the meeting, it was a very successful meeting.

Dr. Barnes of the University of Iowa, Chairman of the Manufacturing Process Division, opened the session by a brief resumé of the 1934 meeting accomplishments. He reviewed the objectives of the manufacturer's laboratories as set-up and agreed upon at the Cornell meeting.

Following this resumé the new program was taken up which was centered around the means to be used in attaining the objectives set forth.

As a start in this direction, representatives of a few schools in different sections of the country were asked to present methods used in their first course in machine laboratory and to evaluate these methods in the light of their own experiences and the objectives as determined. These objectives may be reviewed in an article by Professor Casberg, of the University of Illinois, published in the February issue of the JOURNAL, page 419. Papers were presented by Professor C. A. Koepke, of the University of Minnesota, Major A. A. Case, of the Georgia School of Technology, and Professor N. F. Ward, of the University of California, Professor Ward's paper being read by Professor L. M. K. Boelter, of the University of California. Discussions were given by Professor J. B. Finnegan, of the Armour Institute of Technology, and by Professor Frank L. Eidmann, of Columbia University. A paper on Manufacturer's Opinions, by Professor A. P. Gwiazdowski of the Case School of Applied Science, was read by Professor R. L. Sweigert of the Georgia School of Technology.

Professor Koepke in his paper compared trade shop training with engineering shop training, emphasizing important differences. He illustrated how the engineering training can be brought out. He states that the methods in many engineering school shops should be analyzed in the light of modern practice. The writer ventures to state that this statement applies to nearly all engineering school shops. He also states that they are constantly studying their shop courses to improve the student's knowledge of how things are made, not how to make things. It is surprising how many schools think they are improving the student's knowledge of how things are made, but are actually attempting to improve his knowledge of how to make things. He states that the college trained engineer with an industrial background has been the best teacher.

Major Case discussed the machine shop work at the Georgia School of Technology. He mentions the use of a classroom with a revolving platform, upon which machines may be placed and operations performed which can be viewed by the student from all angles as the platform turns.

Professor Ward's paper gave an illuminating discourse on the type of methods used at California. The space is too limited here to give much of the method which is really a training in engineering. His conclusion states that the instruction by means of lectures and laboratory in the field of mechanical engineering production develops the principal fundamentals of engineering production.

Professor Finnegan in his discussion, made many pertinent

comments. He stated that in a report of the Committee on Shop at the Armour Institute of Technology, which was issued in March, 1935, the objectives of shop courses are defined in almost exactly the terms used by the Manufacturing Processes Conference at the 1934 meeting. The recommendation by the Armour Committee was to the effect that shop courses shall be directed by an engineer who is competent to maintain necessary correlation with other subjects included in the curriculum. He does not agree with the opinion that shop courses should follow the routine which is appropriate in commercial plants, nor does he believe it necessary to make products to be sold to students or on the market for added motivation for engineering students. A Chemical Laboratory course need not provide a cake of soap to be taken home. The important product of the hours spent in the shops is the student himself.

Professor Eidmann gave an interesting discussion of his own experience and what they were doing at Columbia. He states that manual shop work by the student is not necessary in order to learn any of the fundamentals of manufacturing processes that he mentioned. He stated also that at Columbia, all mechanical engineering students are required to spend 200 hours during the summer either as a worker or an observer. A written report is also required.

In Professor Gwiazdowski's discussion on opinions received from various men in industry, there seemed to be one general characteristic. These men appeared to be thinking more of mechanics than engineers. However since quotations were given, it is possible that a reader might misinterpret the opinions.

A paper by Professor O. W. Boston of the University of Michigan, who at the last minute was unable to be present, gave the methods at the University of Michigan.

In a short resumé of the session such as this report, it is impossible to give all the worthwhile results of the meeting.

Part of this material will be published in the JOURNAL. The Division on Manufacturing Processes hope to be able to send out the remainder during the year to the large number that signified their interest in this material at the meeting.

R. L. SWEIGERT,
Secretary

MATHEMATICS

The conference on mathematics was held June 24 and 25, the general topic of the conference being the "Application of Mathematics to Engineering." Professor D. M. Smith of Georgia

School of Technology and Professor Louis O'Shaughnessy of Virginia Polytechnic Institute presided at the two sessions which were marked by intimate and constructive discussions.

Nine papers were presented at the conference, the first six being concerned with specific applications of certain branches of mathematics to various fields and problems of engineering.

Doctor S. A. Schelkunoff of Bell Telephone Laboratories presented an unusually interesting expository paper upon "Coaxial Transmission Lines." Coaxial pairs of cylindrical conductors, once studied on account of their relative simplicity by mathematicians, have been recently utilized as broad band transmission lines, the object of which is to provide a means for sending from two hundred to a thousand telephone conversations over the same pair of conductors or to transmit television signals requiring very wide frequency bands for their faithful reproduction. Thus, once purely theoretical problems have acquired an immense practical significance. The electromagnetic theory itself has become increasingly more important to many practical engineers.

"Recent Developments in The Mathematical Theory of Heat Conduction in Solids" was the title of a paper presented by Professor R. V. Churchill of the University of Michigan. This paper is essentially a bibliography covering the publications in this field from 1921 to 1935 and is accompanied by a brief discussion of those developments of major importance advanced during this period.

The paper of Professor J. G. Estes of North Carolina State College, on "The Application of Volterra's Functional Calculus to the Problem of Flow about an Arbitrary Aerofoil" was read by title.

Professor Estes was killed in an aeroplane accident June 2, his untimely death being a serious loss both to mathematics and aeronautical science. The mathematics section extends sincere sympathy to the family and friends of Professor Estes.

Professor Walter J. Seely of the Department of Electrical Engineering of Duke University presented a paper on "Applications of Mathematics to Electrical Engineering." In this paper a plea was made to those teachers of mathematics, who instruct engineers, to inspire the student with a real interest in mathematics so that when mathematical processes and forms with which he is unfamiliar arise in his other work he will be interested enough in their mathematical aspects to look into their origin and derivation so as not to have to accept them in blind faith. Several examples which arise in electrical engineering courses were outlined, showing—though they may be unfamiliar to the student—

how they may be easily understood and developed by anyone interested in their mathematical aspects.

Mr. B. Pinkel, N. A. C. A., Langley Field, Virginia, discussed an "Application of Heaviside's Operational Calculus to the Analysis of a Fuel Injection System," the rate of discharge of the fuel from the injection valve being obtained.

Professor Louis Brand of the University of Cincinnati presented a paper on "The Method of Moment Distribution for the Analysis of Continuous Structures." In his method (due to Hardy Cross) for computing the terminal moments of the members of a continuous structure, the structure, considered as initially loaded with its joints held against rotation, has its joints successively released while the others are held fast, thus gradually approaching its shape at equilibrium. In the corresponding calculation, successive approximations for the terminal moments are obtained. Professor Brand showed that the series for these terminal moments converge, irrespective of the type of structure, and that they approach values which satisfy the slope-deflection equation and the equation of equilibrium at the joints.

Professor Richard S. Burington of Case School of Applied Science presented a paper on "The Application of the Theory of Matrices to the Theory of Electrical Circuits." The theory of matrices, until recently confined largely to purely theoretical considerations, has appeared in a number of recent papers on electric circuit theory. In some of these papers the language of matric theory has been used with varying degrees of elegance and generality, and in others the notation of the particular application has been used the matric theory generality not being recognized. Certain manifestations of matric algebra in circuit theory were discussed, particular emphasis being placed upon certain types of matric equality relationships (and accompanying theory) in the light of their physical significances. A short bibliography together with a discussion of the relation of the present work with that of Kron, Cauer and others was included.

Professor C. E. Bullinger of Pennsylvania State College presented a report of the committee on coöperative tests. This report sponsored by the committee on student selection and guidance of the engineering council for professional development, Dean R. L. Sackett, chairman, has as its purpose the finding of a test which will predict scholastic success in an engineering curriculum. The method consists of a testing program given to prospective students of engineering before they enter the curricula, the result of these tests to be compared with success in that curriculum. Tests in the

order of their predictive value were found to be mathematics and English. Details of this study will appear elsewhere.

Professor Herman W. Smith gave a detailed report on the "Mathematics placement test" given at the Oklahoma Agricultural and Mechanical College.

Professor J. H. Weaver of Ohio State University, chairman of the conference, presented a summary of the report of the committee on "Advanced Mathematics for Engineering Students." The committee, consisting of Richard S. Burington, T. C. Fry, H. L. Rietz and J. H. Weaver, chairman, reported that a questionnaire had been sent to twenty-five representative engineering colleges and that twenty-two replies had been received. The replies showed that there were twenty distinct courses beyond the elementary course in calculus that were offered to undergraduate engineers. All institutions reported offered one or more courses in differential equations, the average time devoted being forty-five lessons. Nineteen institutions offered courses in advanced calculus, the average time being seventy lessons. Fourteen institutions offered courses in vector analysis, the average number of lessons being fifty-four. The other seventeen courses were given by only a small number of institutions, ten of them being given by only one institution.

The analysis of the topics taught in the courses in differential equations, advanced calculus and vector analysis shows that the courses have become fairly well standardized. The widest variety of topics was found in the courses in advanced calculus, though a fundamental set of topics seems to appear in all courses, other topics being added as time permits.

RICHARD S. BURINGTON,
Secretary.

REPORT OF THE COMMITTEE ON ADVANCED MATHEMATICS

After the conference at Ithaca in 1934, an unofficial group of members met and discussed the questions raised during the conference and in the light of these questions attempted to determine what should be the possible further activities of the mathematics group in the S.P.E.E. After some discussion it was decided to suggest to the council of the S.P.E.E. that a fact finding committee be appointed to ascertain the amount and kinds of mathematics beyond the elementary course in the calculus that were required of or elected by undergraduate students of engineering in the colleges of this country, and that these facts should be used as a basis for discussion relating to future policies. The council acted favorably on the suggestion and authorized the appointment of such a committee, and in due time the following men were named as members:

W. J. Berry, Brooklyn Polytechnic Institute
W. E. Brooke, University of Minnesota
F. W. Bubb, Washington University, St. Louis
R. S. Burington, Case School of Applied Science
B. F. Dostal, University of Florida
A. M. Dudley, Westinghouse E. and M.
H. A. Fisher, North Carolina State College of Ag. and Eng.
T. C. Fry, Bell Telephone Laboratories
H. K. Fulmer, Georgia Institute of Technology
H. W. March, University of Wisconsin
E. J. Oglesby, University of Virginia
L. O'Shaughnessy, Virginia Polytechnic Institute
H. L. Rietz, University of Iowa
*W. P. Webber, University of Louisiana
J. H. Weaver, Ohio State University, Chairman

After considerable discussion it was agreed to send a brief but comprehensive questionnaire to twenty-five representative institutions. In order to insure as many replies as possible, the catalogues of the institutions chosen were studied and the courses in mathematics offered to undergraduates in the colleges of engineering were listed. The titles of the courses offered at a particular institution were then written in the questionnaire sent to that institution. In order to obtain uniformity in the replies, a sample questionnaire completely filled out was included with each one sent. A stamped addressed envelope was also included. A copy of the questionnaire is shown below.

Ohio State University *Reported by:*

Course	Hr. Wk.	No. Wks.	Req. of	Elected by	Text Used
Adv. Calculus.....					
Diff. Equations.....					
Vector Analysis.....					
Math. for Engg.....					
Complex Variable.....					

Topics covered in Advanced Calculus—
Topics covered in Differential Equations—
Topics covered in Vector Analysis—
Topics covered in Mathematics for Engineers—
Topics covered in Complex Variable—

In your opinion should the first course following the introductory course in the calculus be a rather general survey course, including as many topics as possible, or should it be a specific course such as differential equations?

What should be the view point in teaching courses in mathematics beyond the calculus to students of engineering?

* Deceased.

Replies to this questionnaire were received from the following twenty-two institutions.

University of Alabama
Brooklyn Polytechnic Institute
Carnegie Institute of Technology
University of California
Case School of Applied Science
University of Colorado
Cornell University
University of Florida
Georgia School of Technology
University of Illinois
University of Iowa
University of Louisiana
Massachusetts Institute of Technology
University of Michigan
University of Missouri
University of North Carolina
Ohio State University
Penna. State College
Purdue University
University of Virginia
University of Washington
University of Wisconsin

In the replies there were twenty different courses listed. They are given below together with the number of institutions offering them.

Differential Equations *	21
Advanced Calculus	19
Vector Analysis	14
Complex Variable	6
Partial Differential Equations	5
Mathematics for Engineers	4
Fouriers Series	4
Theory of Equations	4
Nomography	3
Heaviside Operators	2
Least Squares	1
Analytic Geometry of Space	1
Generalized Coördinates	1
Limits and Series	1
Definite Integrals	1
Analysis of Observations	1
Matrices	1
Calculus of Variations	1
Harmonic Analysis	1
Elliptic Integrals	1

* The University of Missouri reported a course in differential equations listed but seldom given. This course was not counted.

The above data show that courses in differential equations and advanced calculus have established themselves in practically all the institutions studied, and that vector analysis is rapidly assuming the same role. Since this is true we will set down in some detail the facts relative to these courses.

Differential Equations

The following eight institutions reported that they offered two or more courses in differential equations.

University of California (Berkeley)
University of Colorado
Georgia School of Technology
University of Iowa
University of Louisiana
Massachusetts Institute of Technology
University of Michigan
Penna. State College

The following table shows by whom the courses in differential equations were taken, and the number of institutions in which they were taken.

	Required	Elected	Total
E.E.	11	9	20
C.E.	2	7	9
M.E.	4	10	14
Physics	8	0	8
Aero.E.	3	1	4
Ch.E.	4	8	12

The following topics were included in all courses:

Solution of equations with variables separable,
homogeneous equations,
exact equations,
linear equations of first and higher orders,
Integration in series,
Approximate solutions,
Applications to engineering and physics.

The following topics were included in the number of courses indicated by the number to the right of the topic:

Partial differential equations	14
Existence theorems	7
Simultaneous linear equations	5
Graphical and numerical work	1

A summary of all courses reported shows an average of 45½ recitations devoted to each course in differential equations.

Advanced Calculus

If we consider courses in Mathematics for Engineers as courses in advanced calculus the following four institutions offered two courses in advanced calculus.

Case School of Applied Science
Ohio State University
Purdue University
University of Wisconsin

The following table shows by whom courses in advanced calculus were taken and the number of institutions in which they were taken.

	Required	Elected	Total
E.E.	2	10	12
C.E.	0	4	4
M.E.	3	7	10
Physics	1	9	10
Aero.E.	0	3	3
Ch.E.	0	10	10

All courses listed the following topics:

Continuity; derivative; partial differentiation; implicit functions; line, surface and space integrals; infinite series; Taylor's expansion; definite integrals.

The following topics were given in the number of courses indicated.

Elliptic integrals	7
Gamma and Beta functions	7
Hyperbolic functions	7
Differential equations	6
Fouriers series	6
Complex variable	5
Vector analysis	5
Calculus of variations	4
Applications to geometry	4
Determinants	4
Probability	4
Curve fitting	4
Bessels functions	1

A summary of all courses shows that an average of 72 recitations were devoted to each course in advanced calculus.

Vector Analysis

The following table shows by whom courses in vector analysis were taken and the number courses in which they were taken:

	Required	Elected	Total
E.E.	1	7	8
C.E.	0	1	1
M.E.	0	4	4
Physics	4	2	6
Aero.E.	0	0	0
Ch.E.	0	3	3

The following topics were covered in all courses:

Vector algebra; vector calculus; differential operators; applications; linear vector operators.

A summary of all courses given shows that an average of 54 recitations were devoted to vector analysis.

The replies to the question of a specific course versus a general course following the elementary course in the calculus were as follows:

Specific course	13
General course	7
No preference	1
No reply	1

In answering the question as to view point in teaching mathematics to engineering students, the replies were as follows:

Taught as a tool subject	6
Taught as pure mathematics with applications	12
No reply	4

The above statistics show that the topic taught in differential equations, advanced calculus and vector analysis have become pretty well standardized. The widest variety of topics comes in the courses in advanced calculus. But we have here also the widest range in time devoted to the subject. There seems to be a fundamental set of topics given in all courses and other topics are added as time permits.

The other courses listed are not offered in a sufficient number of institutions to justify a detailed analysis. Consequently such analysis is omitted from this report.

J. H. Weaver,
Chairman.

MECHANICAL ENGINEERING

The quality of the papers and discussions, together with the unusual interest and large attendance, were the features of the Mechanical Engineering Committee Conferences held at the Atlanta meeting. The local arrangements for the Committee were made by Professors R. S. King and R. S. Trotter of the Georgia School of Technology. The dinner meeting on the first evening was arranged by Mrs. R. S. Trotter.

At the first committee conference, under the chairmanship of Professor R. S. King, the general subject was "Methods of Mechanical Engineering Laboratory Instruction." Professor H. S. Howell of Georgia explained the methods used at Georgia School of Technology and submitted an abstract of a survey of methods employed in about fifty shop laboratories. He distributed mimeographed copies of his paper. Professor L. M. K. Boelter of the University of California presented an outstanding paper on the fundamental philosophy of laboratory practice, which received much favorable discussion and comment. This paper has been selected by the Committee for publication in the JOURNAL.

The second conference was a dinner meeting at the Minerva Tea Room in downtown Atlanta. The attendance was sixty-five, with forty-one institutions being represented. Professor Frank L. Eidmann of Columbia University introduced the scheduled subject—"Modifying the Mechanical Engineering Curriculum to Meet Changing Social and Business Conditions." Dean J. J. Wilmore of Alabama Polytechnic Institute introduced the subject with a plea for an ultimate strengthening and unifying of the engineering profession by means of undergraduate activities. Professor H. F. Godeke of the Texas Technological College emphasized his conclusion that a modification of methods of teaching is much more necessary than a modification of the curriculum. Mr. C. E. Davies, Secretary of the A. S. M. E., discussed the activities of the E. C. P. D. and stressed the necessity for increased coöperation between the engineering colleges and the professional societies. Professor Theodore Baumeister of Columbia explained some interesting details of new Mechanical Engineering Curriculum at Columbia University.

The third committee conference was a joint session with the Industrial Engineering Committee, under the chairmanship of Professor Paul T. Norton of the Virginia Polytechnic Institute. A discussion of "The Teaching of Engineering Economy" was continued here from the conference at the Cornell meeting. The Mechanical Engineering Committee contribution was "The Teaching of the

Cost Aspects of Engineering in Schools," by Professor E. D. Ayers of the University of Wisconsin.

"Present Day Shop Methods and Their Evaluation" was the basis of discussion for the fourth committee conference held jointly with the Industrial, Machine Design, and Manufacturing Process Committees. Major A. A. Case of Georgia represented the Mechanical Engineering Committee.

CIVIL ENGINEERING DIVISION

FRED L. PLUMMER, *Chairman* — H. C. BIRD, *Secretary*
FRANK KEREKES — K. C. REYNOLDS
L. E. GRINTER — H. E. BABBITT

Comments of the Chairman

With this issue of the JOURNAL there appears for the first time, a page devoted specifically to the interests of the teachers of Civil Engineering and related subjects. Through the coöperation of the Editors of the JOURNAL, similar space in each succeeding issue will be allotted to the Civil Engineering Division so that its various officers and committee chairmen may have an opportunity of keeping Civil Engineering teachers informed of the activities and accomplishments of the Division.

This Division was formed at the Ithaca Meeting of the Society in June 1934. During the year 1934–35, and under the exceptionally able and energetic leadership of Chairman Frank Kerekes of Iowa State College, the Division was completely organized; an exhaustive statistical study, upon which Professor Kerekes will report later, was made; and an outstanding conference, discussed elsewhere in this issue, was planned for, and held at the Atlanta Meeting last June.

The Division is governed by a council of six (two elected yearly) including the Chairman and Secretary as noted above. Eight major committees have been formed. These together with the committee chairmen for the current year are as follows:

I. *Educational Policy and Teaching Methods*
H. S. Rogers — Polytechnic Institute of Brooklyn

II. *Structural Engineering*
L. E. Grinter — Texas A. and M. College

III. *Sanitary Engineering*
R. G. Tyler — University of Washington

IV. *Transportation*
R. A. Moyer — Iowa State College

V. *Applied Hydraulics*
F. M. Dawson — University of Wisconsin

VI. *Construction Education*
W. C. Huntington — University of Illinois

VII. *Foundations and Soil Mechanics*
Arthur Casagrande — Harvard University

VIII. *Geodesy and Surveying*
Paul P. Rice — Lafayette College

The officers of the Division look forward confidently to a year of fruitful activity culminating in a special conference to be held at the Annual Meeting next June at the University of Wisconsin. Members of the Council and Committee Chairmen will welcome the suggestions which you can, and I hope will, offer to them.

REPORT OF THE COMMITTEE ON SECTIONS AND BRANCHES

We meet in the heart of the Southeast Section of our country and of our Society. This section which had its initial meeting here last November, covers a vast territory, and will be of service to a large number of institutions. There was a thought that it is perhaps too large a territory, and should be split into two or three. Under the guidance of Dean Floyd Field, of Georgia Tech., it was deemed best to start with one large section, which has had an auspicious beginning.

Prof. J. B. Finnegan, of Armour Institute, has engineered the organization of the new Illinois-Indiana Section, which includes members from Armour, Illinois, Purdue, Rose, and several other engineering schools within reach of Chicago. An organization meeting was held at Chicago in February, and the first regular meeting at Purdue in April.

Madison, Wisconsin, was the scene of the first meeting of a brand new Section, which includes University of Iowa, Iowa State, Marquette, Michigan School of Mines, and Wisconsin. Prof. F. M. Dawson, of Wisconsin, reports that the gathering was an enthusiastic one, and the new section is off to a flying start.

A branch was started at the University of Detroit in December 1934, under the leadership of Dean C. J. Freund.

In all of these instances your Committee has been in touch with the leaders of these movements, lending what aid and encouragement it could, and discussing the geographical limits of the proposed sections with the best interests of the parent society in view.

An inquiry sent to all section and branch secretaries this spring indicates a healthy state of growth and interest in the meetings of these geographical subdivisions. Many reports show large numbers of non-members in attendance, and in several instances distinct efforts have been made to encourage this. The subjects discussed at these meetings seem to be of a satisfactorily broad and interesting nature, with enough of constructive purpose in them to serve the real ends of the Society.

The section affiliations of members in certain parts of the country still remains a problem. In the southwest, where distances are great and population sparse, this question is quite acute. Dean Flath, of Southern Methodist University, reports the willingness of certain New Mexico members to be included in the Texas Sec-

tion. The formation of the Allegheny Section to include central and western Pennsylvania, and West Virginia, will help solve the problem in this quarter.

Respectfully submitted,

J. R. MORGAN, Colorado School of Mines,
R. L. FLANDERS, Oklahoma A. & M.,
D. M. WILSON, Univ. Southern California,
F. M. DAWSON, Univ. Wisconsin,
L. L. VAUGHAN, North Carolina State Col.,
E. H. FLATH, Southern Methodist Univ.,
C. G. THATCHER, Swarthmore College, *Chmn.*

REPORT OF COMMITTEE ON RELATIONS WITH INDUSTRIAL AND TRADE ASSOCIATIONS FOR 1933–34 AND 1934–35, S. P. E. E.

Since this is the first report of this Committee since its appointment in 1933 by former President Wickenden, a summary will be given of the committee's activities for the two years, 1933–34 and 1934–35.

Shortly after its appointment in 1933 the Committee was asked to represent the interests of the society in the matter of a code for commercial testing laboratories which was being formulated under the National Recovery Act. Several items in the proposed code would have been decidedly annoying to the research activities of the engineering colleges and the committee conducted a vigorous correspondence to get the proposed code modified in such a way as to safeguard the interests of the colleges. Some of the larger universities with strong engineering experiment stations were also represented directly in the negotiations. After protracted correspondence during the entire session of 1933–34 the entire matter was dropped by action of the National Recovery Administration.

While the committee of the testing industry which was attempting to set up a code authority showed an excellent spirit in considering the suggestions made by your committee, the very fact that they were endeavoring to include the colleges and universities shows a lack of understanding and sympathy between the two groups for which the educational institutions may be largely responsible. The fundamental purposes of university research and of these commercial laboratories are so clearly different and yet so closely allied that there should be no misunderstanding. The chairman of this committee ventures the suggestion that every college engaged in or permitting any commercial testing should outline its policies and control the testing done in such a way as not to compete with these commercial laboratories. The college laboratories can find bigger things to do than to allow some instructors to make their cigarette money by conducting routine acceptance tests where commercial facilities are available.

It early appeared to the committee that the National Recovery Act, with its resulting codes and trade associations, offered an excellent opportunity for the research agencies of the colleges to assist in permanent recovery to the extent that science might contribute by developing new industries and new and better products and by the utilization of waste products, etc. An effort was made, but without

much success, to interest the National Recovery Administration in encouraging these newly formed trade associations to set up research programs in the same way that many of the older associations which existed prior to N. R. A. have maintained extension research activities. While efforts to work through N. R. A. were fruitless, yet many institutions with direct contacts have been able to make very interesting connections with certain of these associations. It seems likely that many more of the engineering colleges might find ways in which their peculiar facilities might be made of service to some industrial association. With small industries, which cannot each alone support research, now organized into national or regional associations, it is possible for extensive research for the benefit of all to be supported at a very nominal expense to each small unit of the industry.

While the recent decision of the Supreme Court has changed the entire aspect of N. R. A., it is believed that many of these associations will continue on a more voluntary basis with less fear of governmental restrictions and control of their activities. It is possible, then, that many of these associations would be interested in entering into coöperative research programs with such of the colleges as may have special facilities or talent of peculiar interest.

After the 1934 meeting of the S. P. E. E. the committee was requested to investigate the effect of these N. R. A. codes on the educational discounts formerly received by the engineering colleges. We learned that there were a great number of such codes involved and that where such discounts were forbidden it would have involved endless work in getting any consideration given to alterations in the codes which evidently could not have been accomplished before the automatic expiration of the Act. In the meantime it now appears that price fixing is definitely out of any future code activity. It may be well to point out that on special equipment for college laboratories, not covered by the standard lines, the manufacturers were never subject to any code limitation and were at all times able to give special prices to educational institutions. The negotiations on this matter brought out a feeling expressed by certain manufacturers that some institutions have purchased standard equipment for general college facilities, but have taken advantage of educational discounts which are intended to apply only to equipment to be used for laboratory purposes. We should at all times play fair with our friends if we wish to retain the advantages of this friendship.

In at least two institutions represented upon this committee contacts with trade associations have been found very helpful in the placing of graduates. There are numerous small industries which could well profit from the services of one or two technical graduates.

It is likely that such opportunities can be best discovered through the trade associations. A particularly effective and dignified procedure is through addresses by college representatives at meetings of such associations. If you, the speaker, can sell the industrialist on your own understanding of his technical problems, then he is more likely to feel that your graduate may be of some service to him. Or if through some research work you can show him the solution of a puzzling problem he is particularly likely to want one of your graduates in the hope that he may be as clever as you are.

Respectfully submitted,

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M. A. LEE, Cornell University,
W. A. SHOUDY, Columbia Univ.,
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BARGER, THOMAS C., Assistant Professor of Mining and Metallurgy, University of North Dakota, Grand Forks, N. D. D. R. Jenkins, E. F. Chandler.

BAUMEISTER, THEODORE, JR., Assistant Professor of Mechanical Engineering, Columbia University, New York City. F. L. Eidmann, G. B. Karelitz.

BLAKESLEE, L. ROBERT, Instructor in Architectural Engineering, University of Detroit, Detroit, Mich. B. N. Blakeslee, C. J. Freund.

CANNON, EDWARD W., Instructor in Mathematics, University of Delaware, Newark, Del. G. A. Koerber, R. L. Spencer.

CARPENTER, LEWIS V., Associate Professor of Sanitary Engineering, New York University, New York City. Thorndike Saville, C. T. Schwarze.

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CLARKE, JAMES S., Instructor in General Engineering, Rutgers University, New Brunswick, N. J. P. H. Daggett, F. H. Pumphrey.

COOLEY, ALBERT M., Instructor in Chemical Engineering, University of North Dakota, Grand Forks, N. D. D. R. Jenkins, E. F. Chandler.

COPELAND, ROBERT M., Professor of Military Science and Tactics, Colorado School of Mines, Golden, Colo. J. R. Morgan, R. A. Baxter.

CROSSLEY, WALTER C., Instructor in Mechanical Engineering, Rutgers University, New Brunswick, N. J. P. H. Daggett, F. H. Pumphrey.

DEVINE, JOHN J., Assistant in Engineering, Rhode Island State College, Providence, R. I. J. A. Hall, C. D. Billmyer.

DWIGHT, HERBERT B., Professor of Electrical Machinery, Massachusetts Institute of Technology, Cambridge, Mass. C. E. Tucker, C. E. Lansil.

EAMES, JESSE J. Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Mass. T. H. Taft, C. E. Tucker.

ENGEL, ERNEST D., Instructor in General Engineering, University of Washington, Seattle, Wash. E. R. Wilcox, F. M. Warner.

FAUCETT, MAX A., Associate in Electrical Engineering, University of Illinois, Urbana, Ill. E. B. Paine, H. H. Jordan.

FINEREN, WILLIAM W., Associate Professor of Mechanical Engineering, University of Florida, Gainesville, Fla. B. R. VanLeer, N. C. Ebaugh.

FULLER, M. O., Professor of Civil Engineering, Lehigh University, Bethlehem, Pa. Hale Sutherland, H. G. Payrow.

GARRETTS, JEWELL M., Instructor in Engineering Mechanics, Columbia University, New York City. J. E. Wadsworth, Robin Fleming.

GARMAN, WARREN D., Professor of Mechanical Engineering, Bucknell University, Lewisburg, Pa. (Re-instated.)

GRAHAM, JAMES H., Dean, College of Engineering, University of Kentucky, Lexington, Ky. L. E. Nollau, W. E. Freeman.

HAGA, LOUIS J., Assistant Professor of Chemistry and Metallurgy, Lewis Institute, Chicago, Ill. J. G. Bennett, R. B. Parks.

HAMLIN, EDWIN W., Assistant Professor of Electrical Engineering, University of Kansas, Lawrence, Kansas. R. H. Frazier, D. C. Jackson, Jr.

HANNUM, JOSHUA E., Editor, The Engineering Index, 29 West 39th Street, New York City. H. N. Walker, C. P. Bliss.

HEATH, EDWARD B., Instructor in Engineering and Mathematics, San Bernardino Valley Junior College, San Bernardino, Calif. F. B. Lindsay, P. S. Biegler.

HENNES, ROBERT G., Instructor in Civil Engineering, University of Washington, Seattle, Wash. F. M. Warner, C. C. More.

HYSLUP, CLARENCE J., Associate Professor of Vocational Guidance, Director, Student Guidance and Placement, Virginia Polytechnic Institute, Blacksburg, Va. E. B. Norris, P. T. Norton, Jr.

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JOHNSTON, BRUCE G., Instructor in Civil Engineering, Columbia University, New York City. J. K. Finch, A. H. Beyer.

JONES, WILLIAM H., Associate Professor of Heat Engineering, Massachusetts Institute of Technology, Cambridge, Mass. T. H. Taft, J. L. Tryon.

KNOWLES, ASA S., Assistant Professor of Industrial Engineering, Chairman of Department, Northeastern University, Boston, Mass. W. T. Alexander, A. J. Ferretti.

KOTH, ARTHUR W., Instructor in Chemical Engineering, University of North Dakota, Grand Forks, N. D. D. R. Jenkins, E. F. Chandler.

LANE, EMORY W., Professor of Hydraulics Engineering, State University of Iowa, Iowa City, Iowa. B. J. Lambert, E. L. Waterman.

LAVINE, IRVIN, Professor of Chemical Engineering, University of North Dakota, Grand Forks, N. D. D. R. Jenkins, E. F. Chandler.

LEE, CLAUDIUS, Professor of Electrical Engineering, Virginia Polytechnic Institute, Blacksburg, Va. R. B. H. Begg, P. T. Norton.

LONG, WAYNE E., Associate Professor of Mechanical Engineering, Texas A. & M. College, College Station, Tex. V. M. Faires, O. W. Crawford.

LOUGHLIN, RAYMOND P., Instructor in Drafting, College of City of New York, New York City. E. Neus, F. Skene.

LUKENS, HIRMA S., Director, Department of Chemistry and Chemical Engineering, University of Pennsylvania, Philadelphia, Pa. R. H. Fernald, G. E. Crofoot.

MCGUIRE, WALDEMAR S., Assistant Professor of Chemical Engineering, Northeastern University, Boston, Mass. W. C. White, S. A. S. Strahan.

MIRGAIN, FRANK C., Instructor in Civil Engineering, Rutgers University, New Brunswick, N. J. P. H. Daggett, F. H. Pumphrey.

MOWBRAY, WILLIAM J., Instructor in Electrical Engineering and Engineering Drawing, Rhode Island State College, Kingston, R. I. Wm. Anderson, R. L. Wales.

MULLOWNEY, PENN E., Instructor in Aeronautical Engineering, North Carolina State College, Raleigh, N. C. R. P. Kolb, L. L. Vaughan.

MYLREA, THOMAS D., Professor and Head, Division of Civil Engineering, University of Delaware, Newark, Del. R. L. Spencer, G. A. Koerber.

OSBORNE, HAROLD S., Transmission Engineer, American Tel. & Tel. Co., New York City. R. I. Rees, O. W. Eshbach.

PAVIAN, HENRY C., Assistant Professor of Aeronautical Engineering, University of Pittsburgh, Pittsburgh, Pa. J. A. Dent, Nell McKenry.

PESTERFIELD, C. H., Acting Head, Mechanical Engineering Department, University of North Dakota, Grand Forks, N. D. D. R. Jenkins, E. F. Chandler.

PHILLIPS, WARREN E., Development Engineer, B. F. Goodrich Company, 1735 11th St., Cuyahoga Falls, Ohio. F. E. Ayer, John Bulger.

RICHARDS, HENRY E., Associate Professor of Electrical Engineering, Northeastern University, Boston, Mass. W. C. White, R. G. Porter.

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SEIDL, JULIUS C. G., Head, Department of Industrial Engineering, Manhattan College, New York City. Bro. A. Leo, D. J. O'Connell.

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TRATHEN, ROLAND H., Instructor in Civil Engineering, Rensselaer Polytechnic Institute, Troy, N. Y. E. R. Cary, H. B. Compton.

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The T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE DIVISION OF ENGINEERING DRAWING

FREDERIC G. HIGBEE, EDITOR

Editorial Reflections: In June, 1930, on the campus of McGill University, to the wailing tunes of Scotch bagpipes, the T-Square Page was conceived and an editor was elected. This editor departed from the McGill campus with resounding assurances of cooperation and contributions ringing in his editorial ears; he was also under the impression that the tenure of his editorship was not to be like that of a professorial chair; for life and/or good behavior! Five full years have passed since that memorable June day on the McGill campus, a sixth year is well on its way; to what extent, the editor of the T-Square Page is constrained to ask, has the Engineering Drawing Division contributed or coöperated in the publication of this page, and to what extent is he editor or sole contributor? The answer is not forthcoming; as an editor we hope the organization ears of the Engineering Drawing Division are assuming an appropriate color as this is read! Editorially, it may now be stated that reference to the bagpipes in the opening sentence is not without significance.

It has been stated, facetiously of course, that the possession of a B.S. degree does not indicate a knowledge of fundamental sciences but rather a lack of knowledge of the arts! And quite without facetiousness it may be stated that attaching the title of "editor" to a name does not imply a limitless store of material of interest to this division, or skill in the fabrication of words so much as it may, perhaps, indicate an unmentionable fundamental deficiency in the organization not yet, at least, overcome.

There is, doubtless, a great store of important information of interest to teachers of engineering drawing and allied subjects buried in the files and minds of the more than one hundred members of the Engineering Drawing Division. The function of an editor should be to select, arrange, classify, and organize contributions from members of the division. Editorially, may we express the hope that we may so function for the remainder of the year?

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Preferred Numbers: C. E. Lucke, Columbia University, New York City.

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1931—DUGALD CALEB JACKSON, Professor of Electric Power Production and Distribution, in charge, Dept., Electrical Engineering, Massachusetts Institute of Technology.

1932—ARTHUR NEWELL TALBOT, Professor of Municipal and Sanitary Engineering, Emeritus, University of Illinois.

1933—DEXTER SIMPSON KIMBALL, Professor of Industrial Engineering, Dean, College of Engineering, Cornell University.

1934—EDWARD ROSE MAURER, Professor of Mechanics, University of Wisconsin.

1935—WILLIAM ELGIN WICKENDEN, President, Case School of Applied Science.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

Charles F. Scott, Professor-emeritus of Electrical Engineering, Yale University, and chairman of the board appointed by Governor Cross to administer the recently enacted engineers' registration law in the State of Connecticut, was elected chairman of the Engineers' Council for Professional Development at the Third Annual Meeting of that body held in New York, N. Y., on October 8. Professor Scott succeeds C. F. Hirshfeld, chief of research of the Detroit Edison Company, who has served as the Council's chairman since its formation. George T. Seabury, secretary of the American Society of Civil Engineers, was reëlected secretary of the Council. New members of the executive committee also elected were C. F. Hirshfeld, representing The American Society of Mechanical Engineers, Harrison P. Eddy, of Boston, Mass., past-president of the American Society of Civil Engineers, representing that Society, and L. W. W. Morrow, managing editor of *Electrical World,* New York, N. Y., representing the American Institute of Electrical Engineers. Other members of the executive committee who continue in office and the societies they represent are: F. M. Becket, of New York, past-president, American Institute of Mining and Metallurgical Engineers, H. C. Parmelee, of New York, American Institute of Chemical Engineers, R. I. Rees, of New York, Society for the Promotion of Engineering Education, and D. B. Steinman, of New York, National Council of State Boards of Engineering Examiners.

At the annual meeting reports of the committees were presented and approved. The four committees under whose guidance the principal activities of the Council are conducted have been set up to cover the four phases of the engineer's training. These are: Committee on Student Selection and Guidance, charged with the pre-collegiate phases; Committee on Engineering Schools, whose interests at present are directed toward carrying out a program of accrediting engineering curricula; Committee on Professional Training, which gives its attention to the problem of the young engineer and recent graduate; and Committee on Professional Recognition, whose concern is with procedures by which the individual becomes a recognized member of the engineering profession.

Because of misunderstandings of the purposes and objectives

of the Committee on Professional Recognition which had arisen since the 1934 annual meeting, the Council adopted a resolution in which it regretted and disclaimed any statement that had been made in its behalf that might have been construed as unfriendly toward the engineers' registration movement, and any intention to set up a certifying agency in conflict with the legal registration of engineers by state boards or to parallel or supplant the National Bureau of Engineering Registration.

At the request of the Committee on Professional Recognition its "Program of Certification," adopted by the Council in October, 1934, was referred back to the Committee for further study and clarification.

NECROLOGY

W. PAUL WEBBER

W. Paul Webber was born at Marseilles, O., August 7, 1874. He was highly trained for his profession of teaching, which he had entered as a young man. He received the bachelor of science degree from Lebanon College in Pennsylvania, and the M.A. degree from Defiance College in Ohio. Also, he had received the M.A. and Ph.D. degrees from the University of Cincinnati. Dr. Webber had won recognition in his work in mathematics, and was the author of several volumes on that subject, including "Elementary Applied Mathematics," "Teaching of Mathematics" and "Periodic Functions." He was the co-author of "Introductory Mathematical Analysis." He was a member of the American Mathematics society, the Mathematics association of America and the Louisiana Academy of Science.

During the 13 years of his service at the University, Dr. Webber had won the esteem and respect of all those with whom he came in contact. Quiet and reserved, he yet had sincere interest in his associates and was never too busy to give attention to them nor to show courtesies to newer members of the staff and faculty. He was held in highest esteem as a gentleman and scholar.

SECTIONS AND BRANCHES

University of Colorado Branch.—On Saturday, May 4, the University of Colorado branch was host to the annual meeting of the Colorado-Wyoming section. Two sessions were held, one at 2:00 P.M., and another at 7:00 P.M., following an informal supper served in one of the engineering buildings. The program was as follows:

Afternoon Session—2:00 p.m.

General presiding officer, Professor J. A. Hunter, University of Colorado, President of Section.

Presiding officer of session, Professor Irving A. Palmer, Colorado School of Mines.

Address of welcome, President George Norlin, University of Colorado.

"The Curriculum in General Engineering," Dean R. D. Goodrich, University of Wyoming.

"The Program of the Engineers' Council for Professional Development," Dean H. S. Evans, University of Colorado.

"The Function of the Department of Engineering Mathematics," Professor C. A. Hutchinson, University of Colorado.

General discussion.

Supper, 6:00 p.m.

Evening Session, 7:00 p.m.

Presiding officer of session, Professor J. A. Hunter.

"Trends in Secondary Education Affecting the Colleges," Roger Q. Mitchell, Superintendent of Schools, Golden, Colorado.

General discussion.

Business meeting.

At the business meeting the officers chosen were Dean R. D. Goodrich, University of Wyoming, president, and Professor Stanley T. Hunt, University of Wyoming, secretary. These succeed Professor John A. Hunter, University of Colorado, president, and Robert A. Baxter, Colorado School of Mines, secretary, who were elected at the Denver meeting of the Section in May, 1934, when the subject of discussion, led by Professor W. Otto Birk, University of Colorado, was "The Attitude of the Committee on English of the S. P. E. E. on the Place of English in the Engineering Curriculum."

University of Detroit Branch.—Two meetings, May 14 and June 10, 1935, were given over to a careful consideration of the Second Annual Report of the Engineers' Council for Professional Development.

Each member of the faculty was required to give his opinion of the report in as detailed a manner as he desired. Each member was required to speak and what he said was recorded by a committee which then assembled the opinions of the various members of the faculty into a consolidated report, which follows:

"The general attitude of the faculty was decidedly favorable to the report with a manifest feeling that it is a step in the right direction.

"The faculty generally agreed that the University of Detroit should apply for accreditization by the E. C. P. D. as soon as possible.

"The following topics of the report brought forth especially favorable comment by the faculty: Reading Lists, Guidance Work, Protest to the S. P. E. E. against dropping the Professional Degree. It was felt that the professional degree has a distinct value in that it signifies a minimum of professional experience and attainment.

"There was a feeling of criticism against the dictating policy of standardizing agencies in general and a recommendation that E. C. P. D. be very cautious in this regard. There was a rather general feeling that standardizing tends to make for uniformity with the suppression of individuality, a fault against which the E. C. P. D. should guard."

Dean Freund addressed the members and guests at the meeting on September 27, welcoming them back to the University for another year.

He reviewed the purpose of the College of Engineering, as expressed in the official bulletin: "It is the aim of the College of Engineering to give such a college education as will best prepare for a career and for a professional standing in the field of engineering and for a useful and happy life. . . . A special aim of the College of Engineering is to encourage students to prepare for the industrial phases of engineering, as distinct from the purely technical and scientific."

In his discussion of these purposes of the College of Engineering, the Dean pointed out methods of improving the standing of the College of Engineering and advised the preparation of the Faculty for examination by such standardizing agencies as the E. C. P. D. and the American Institute of Chemical Engineers. The faculty was urged to prepare projects for research and to

write about these projects, and the progress which might be made in their solution.

Texas Section.—*General Session:* The meeting was called to order by the chairman, E. H. Flath of S. M. U., president of the section, at the Texas Technological College at Lubbock, April 19, 1935.

J. A. Orr of Texas A. and M. presented a paper on "The Five Year Curriculum in Engineering." H. J. Miles of S. M. U. gave a discussion for H. F. Huffman of S. M. U. L. E. Grinter of A. and M. read a discussion by H. C. Doremus of John Tarleton. The paper was discussed from the floor by R. D. Campbell, F. C. Bolton, J. A. Focht, J. H. Murdough, and N. F. Rode.

J. A. Correll of Texas University gave a paper on "Remodeling the Engineering Curriculum to Meet the New Economic Conditions." F. C. Bolton of A. and M. discussed the subject. S. Thompson of S. M. U. read a discussion prepared by R. L. Peurifoy of C. A. and I.

O. A. St. Clair of Texas read a Synopsis of the report of National S. P. E. E. Committee on "Uniformity of Engineering Degrees" by Dean O. M. Leland, University of Minnesota, Chairman of Committee. H. F. Godeke of Texas Tech read a discussion by Dean C. C. Williams of the University of Iowa, of Dean Leland's paper. J. A. Correll of Texas University discussed the subject of "Uniformity of Engineering Degrees" for T. U. Taylor of Texas University. O. A. St. Clair read a letter by Dean Leland discussing Dean William's comments on the committee's report. H. F. Godeke closed the discussion by reading a letter of rejoinder by Dean Williams.

E. H. Flath, Chairman, appointed the following committees:

Nominating: H. E. Degler, Chairman, Texas University; L. E. Grinter, A. and M.; J. H. Murdough, Texas Tech; Sophus Thompson, S. M. U.; M. C. Stone, N. T. A. C.

Resolutions: F. C. Bolton, Chairman, A. and M.; R. D. Campbell, S. M. U.; J. A. Correll, Texas University; O. A. St. Clair, Texas Tech; F. M. Smith, N. T. A. C.

Meeting adjourned at 5:15 P.M. About 70 present. Inspection of buildings conducted.

Banquet: M. C. Stone, presiding, Woman's Hall, 7:15 P.M., April 19, 1935. President Bradford Knapp of Texas Tech gave the address of welcome, J. A. Focht of Texas University responded in place of T. U. Taylor of Texas University for the Texas Section.

E. H. Flath of S. M. U. gave an address on "The Engineer and the Consumer."

Adjourned at 9:30 P.M. 94 present, including several attending the American Mathematical Association.

Business Session: The meeting was called to order by E. H. Flath, Chairman, April 20, 1935.

Minutes for last year's meeting were approved.

Dean F. C. Bolton of A. and M. extended an invitation to the society to meet at A. and M. in 1936. Carried.

H. E. Degler, Chairman of the nominating committee made the following report, which was accepted:

President, O. V. Adams, Texas Tech.
Vice-President and Chairman of the Program Committee, C. W. Crawford, A. and M.
Secretary-Treasurer, J. A. Orr, A. and M.
Executive Committee (3 year term ending 1938): L. V. Uhrig, Rice Institute; C. E. Rowe, Texas University; N. F. Rode, A. and M.

J. A. Focht of Texas University gave a report for the Mathematics Committee, J. W. Ramsey, Chairman, presenting data from several Texas Colleges in regard to the status of students in mathematics. Moved that the committee be continued and the executive committee member of each school be asked to coöperate. Motion carried.

R. C. Goodwin of Texas Tech read the report of the committee appointed to study a plan for "Improving the Quality and Quantity of High School Entrance Units Presented by Freshmen." The following people were members of the committee: O. V. Adams, Chairman; J. G. Allen, W. P. Clement, R. C. Goodwin, C. C. Schmidt, F. W. Sparks, and O. A. St. Clair, all of Texas Tech.

H. E. Degler moved that O. V. Adams, Chairman, present the following three (1, 2, 3) recommendations of the committee to the Texas State Board of Education:

(1) That we, the Texas Section of S. P. E. E., express our approval of the efforts of the State Board of Education to require teachers in the secondary schools to be proficient in the subject matter which they are assigned to teach.

(2) That the State Board of Education be urged to publish an annual report showing the college records of freshmen graduating from the various high schools.

(3) That we do everything in our power to bring to the attention of the State Board of Education and the administrative officials of our secondary schools the program of the Committee on Student Solution and Guidance of the Engineer's Council for Professional Development, and that we urge individual members of

our faculties to acquaint themselves with this program and to render such individual service as they may to officials of our secondary schools.

The motion was seconded from the floor and carried. F. C. Bolton moved that recommendations 4, 5 and 6 be communicated to the State Superintendent of Public Instruction and the State Board of Education. Seconded by J. C. Hardgrave and carried. These motions are as follows:

(4) That officials in charge of the curriculum revision movement be urged to give consideration to, and make provision for, the adequate high school preparation of high school students who wish to study engineering.

(5) That administrative officials in secondary schools be urged to employ at least one teacher who is competent to give educational and vocational guidance in engineering.

(6) That we believe it advisable and necessary to the foregoing recommendations that high school students who wish to study engineering be urged to take as many of the following subjects as possible in their senior year, namely: English, chemistry, algebra, solid geometry, physics, and mechanical drawing, and that such subjects be made available in the senior year of high school.

F. C. Bolton discussed recommendation (7) of the committee and urged that it be brought to the attention of Texas Colleges by the incoming president. It is as follows:

(7) That entering freshmen in engineering, who are found to be proficient in rhetoric and composition at the time of entrance, be given the option of taking work in literature or other advanced courses in English instead of the regularly required freshmen English.

Group Meetings—held simultaneously beginning at 10:15 A.M.

Session for those not attending Group Meetings, F. C. Bolton, presiding.

W. E. Street of Texas Tech gave a paper on " A Comparative Study of the Results of Psychological Tests of Engineering Freshmen at Texas Tech."

O. V. Adams of Texas Tech discussed the report of the national Committee on " Student Selection and Guidance."

J. H. Murdough of Texas Tech talked on the report of the National Committee on " Engineering Schools."

General discussion of the last two topics.

Electrical Engineering: J. A. Correll, presiding.

E. H. Flath of S. M. U. gave a paper on " Apportionment of Time Between Machinery, Power Transmission, Communications and Electronics in a Four Year Course." Open discussion.

M. C. Hughes of A. and M. presented a paper on "Course Content and Methods for Electrical Machinery Courses for Non-electrical Students." General discussion.

Engineering Drawing: O. A. St. Clair, presiding.

Minutes for last year read and approved with the following correction: Change the word Relations in title of E. L. Williams to Education. Program report by C. L. Svensen, chairman program committee, giving list of topics submitted. Motion by H. C. Spencer that chairman appoint committee to take over material in C. L. Svensen's report and prepare program for next year.

C. E. Rowe of Texas University gave a paper on " Descriptive Geometry—Past, Present, and Future."

F. M. Smith of N. T. A. C. presented a paper on " Content of a Drawing Course—Subject Matter."

R. D. Campbell of S. M. U. talked on " Content of a Drawing Course—Quality and Quantity."

H. C. Spencer of A. and M. read a paper on " Sketching and Pictorial Methods in a Course in Drawing."

The chair appointed the following program committee for next year: H. C. Spencer, A. and M.; L. D. Keaton, E. T. S. T. C.; C. L. Svensen, Lubbock.

C. L. Svensen resumed chair and brought up the question of a correspondent for T-Square Page of S. P. E. E. C. L. Svensen nominated and elected.

C. E. Rowe nominated and elected secretary.

W. E. STREET,
Secretary and Treasurer.

BOOK REVIEWS

Generating Stations. ALFRED H. LOVELL. McGraw-Hill Book Company, Inc. 437 pages. $4.50.

Under present economic conditions, where very few graduating engineers are absorbed in design or strictly engineering work, it becomes more than ever necessary that the graduate should know more than the pure sciences.

" Generating Stations," by Alfred H. Lovell, is already well known in the educational field and, for the past five years, has been offering the young engineer an opportunity to apply the elements of economics to the problems of power plant and transmission design in the selection of apparatus, in propositioning the details in an assembled whole, and in balancing the initial and subsequent costs.

The second edition of " Generating Stations " has brought the text up to date with several new developments. Some of these are, the application of the mercury vapor-steam cycle; some new turbine units of special interest; hydroelectric projects undertaken by the Federal Government; improvements and increased use of internal combustion prime movers; and the establishment of a new high voltage for long-distance transmission. The outstanding advances in new oil circuit-breakers and high-speed relays and applications are discussed. Considerable attention has been given to the rehabilitation and improvement of old stations because of present economic conditions.

Well chosen problems are included at the end of each chapter. There are a total of 89 problems in the second edition as compared to 68 in the first edition.

JAMES A. WASMUND.

Mechanical and Electrical Equipment for Buildings. CHARLES MERRICK GAY AND CHARLES DE VAN FAWCETT. John Wiley & Sons, Incorporated. 412 pages. $5.00

This text should adequately meet the demands of a number of different Electrical, Architectural, and Civil Engineering courses, in design and application. It should also prove to be a valuable aid to practicing architects and building contractors.

The 412 page text is divided into five major sections, namely: Water Supply, Plumbing and Drainage, Heating and Air Condi-

tioning, Electrical Equipment, and Acoustics. Each subject is treated in a thoroughly technical manner but is stated in such clear simple terms as to be readily understandable to the average reader.

The relatively new field of air conditioning is especially well treated in this text; one entire chapter of 26 pages being devoted to the theory and design, and another of 24 pages to application and equipment.

The electrical portion of the book covers materials and methods of installation, principals of electrical design, network wiring systems, electrical machinery, elevators, and lighting, in a thorough manner, beginning with fundamental electrical laws.

That section of the book relating to architectural acoustics should be especially welcomed because of the scarcity of reference works on this important subject.

This book is in no sense a handbook for the purpose of engineering design, but should be of value in bringing the engineer and architect together so that they speak the same language.

J. A. WASMUND.

G-E *Campus News*

PATENTED LILIES

WHEN left to their own devices, regal lilies get themselves all spattered by yellow pollen. It's a messy business—like a man in a white linen suit spilling egg yolk all over his vest. So the florists have to watch these blooms carefully and pluck the pollen-laden anthers before they have a chance to burst.

In the General Electric Research Laboratory, J. N. Moore, Dartmouth, '05, has for years been investigating the biological effects of x-rays. Among other things, he treated 75 regal-lily bulbs with varying amounts of x-rays. Untreated bulbs of the same batch grew up normally. Among the treated bulbs, there were some monstrosities and some apparently normal flowering plants. The results were different the next season. The progeny of two of the bulbs that had received 30-second doses of x-rays produced flowers with nonshedding anthers. Each year the new strain has continued true, and the nonshedding property is considered a fixed characteristic. The Roentgen lily is now established as a variety of regal lily.

GOOD-BYE, GARBAGE CAN

THE oil furnace has placed the skids under the ash can. And now, a new device developed in a General Electric laboratory promises to do away with the garbage can. This new device, operated by a ¼-horsepower electric motor, grinds the garbage. Grinding knives made of Carboloy—a metal next to diamond in hardness—shred all types of waste food, including bones and other hard substance. The only things it cannot handle are glass and tin cans. Reduced to a fine pulp, this waste is flushed by water into the sewer. The grinder is simple to install and operate. The entire unit weighs about 75 pounds, and may be installed under any style of sink as a part of the outlet plumbing. The hopper inlet is covered by a perforated cap, flush with the sink bottom. When the hopper is full, all one has to do is turn a handle which projects conveniently from beneath the sink. This closes the hopper and starts the grinder.

AWARD FOR COURAGE

IN the face of a difficult and serious competitive situation, the entire personnel of the Tennessee Electric Power Company, of Chattanooga, under the leadership of its president, proceeded to develop one of the most unique sales programs ever carried out by an American public utility. Every individual in the organization, regardless of position, became a salesman for the company's kilowatt output. One of the bases of this program was a substantial reduction of rates. The result was a great increase in electric-appliance sales, and a 26-per-cent increase in residential consumption.

For its accomplishments, the Tennessee Electric Power Company received the annual award for 1934 of the Charles A. Coffin Foundation, which was established by General Electric in 1922 in honor of its first president. The award comprises the Charles A. Coffin gold medal, a certificate, and a check for $1000 to be deposited in the treasury of the utility's employee welfare association.

96-179FBI

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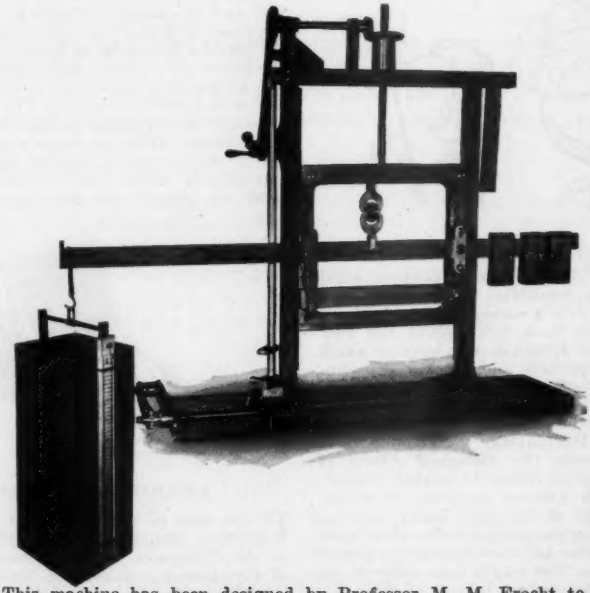

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